U.S. Army Corps of Engineers
Walla Walla District

Lower Snake River Programmatic Sediment Management Plan

Draft Environmental Impact Statement

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Appendices G through L

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Appendix G: Scoping Summary: Lower Snake River Programmatic Sediment Management Plan and Environmental Impact Statement

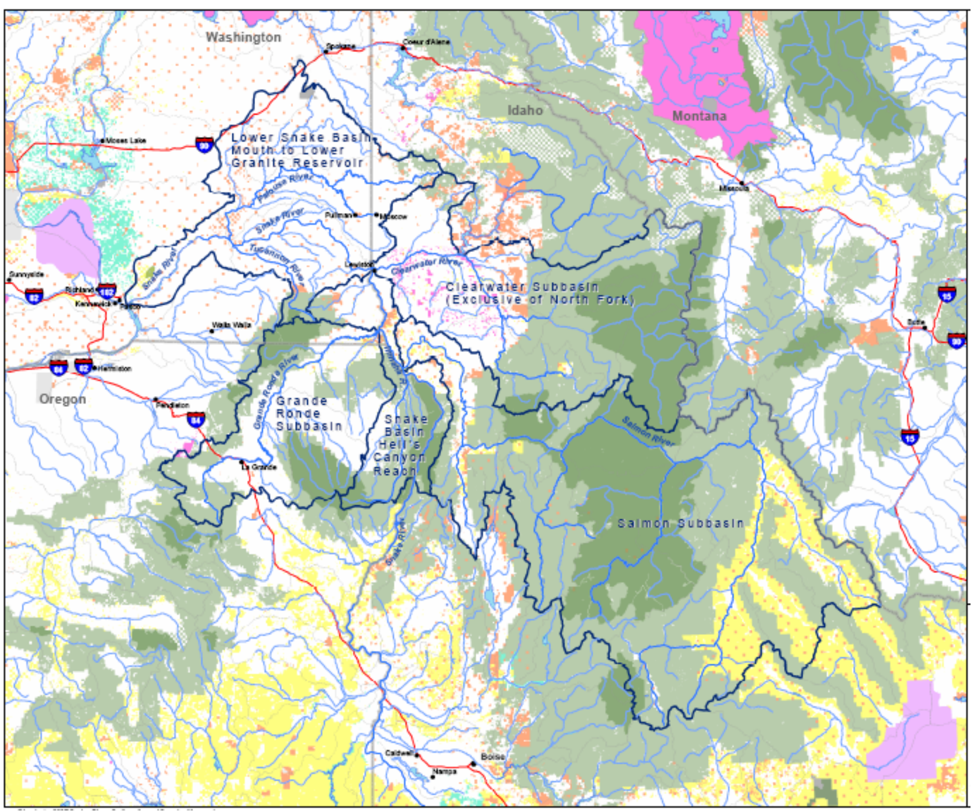
Prepared by USACE, 2007

US Army Corps
of Engineers
Walla Walla District

Scoping Summary

Lower Snake River Programmatic Sediment Management Plan and Environmental Impact Statement

August 2007



Introduction

The Walla Walla District Office of the U.S. Army Corps of Engineers (Corps) is preparing an Environmental Impact Statement (EIS) for a Programmatic Sediment Management Plan (PSMP/EIS) to address sediment management within the lower Snake River, including the four reservoirs managed by the Corps. The plan will identify and evaluate ways the Corps can manage sediment within these reservoirs, and examine sediment sources on a programmatic basis in the near-term, mid-term, and long-term. The study area considered includes the four lower Snake River reservoirs extending from the mouth of the Snake River upstream through the Hell's Canyon Reach of the Snake, and the Tucannon, Asotin, Palouse, Clearwater, Salmon, Imnaha, and Grande Ronde watersheds.

During the fall and winter of 2006-2007, the Corps held a series of technical workshops, public scoping meetings, and individual interviews throughout the affected region. The purpose of this report is to summarize information that was gathered during this public and government agency scoping process. The information gathered during this scoping process will assist in identifying issues to be considered in the development of the EIS.

The scoping process was divided into four components: 1) A preliminary scoping meeting held on September 26th, 2006 in Clarkston, Washington; 2) a series of pre-scoping stakeholder meetings and interviews with individuals, conducted from October 2006 through February 2007 at locations within sub-basins throughout the affected region; 3) public scoping open houses and meetings during February, 2007 at four cities within the region; and 4) written scoping comments.

Pre-Scoping Meeting for the Local Sediment Management Group (LSMG)

A preliminary scoping meeting was held in Clarkston, Washington. Invitees to this meeting included agencies or organizations that were participating members of the original lower Snake River Local Sediment Management Group (LSMG) or representatives of organizations who were identified to be an important contributor to the Corps' refocused sediment management approach. The purpose of this meeting was to provide an overview of the planning process, describe progress made to date, and begin efforts to re-establish the LSMG for the PSMP/EIS process.

The meeting consisted of presentations by Corps' and contractor staff on the history and project background; the purpose, objectives, and timeline of the PSMP and LSMG; and the project challenges. The presentations were followed by questions and a discussion on issues to be considered and data sources.

The participants noted that there are a number of data sources available, including recent aerial photography/remote sensing imagery and soil mapping. Participants said that it will be necessary to examine long-term data sets that are available from the U.S. Forest Service (USFS), U.S. Geological Survey (USGS), Natural Resource Conservation Service (NRCS), universities, and other organizations.

The following is a summary of the participants' identified issues and comments:

- Rather than develop all new information, there are a number of existing studies and efforts (e.g., subbasin plans) that provide good data and sediment-source evaluations. These studies can help identify "hot spots" and priorities for sediment reduction actions.

- It is necessary to stress that the PSMP is not another dredging project. This misperception among resource organizations could discourage participation.

- It was not clear how the Corps could assure implementation from other agencies.

- There were questions about the form of the final product. In addition to the EIS, will it include an action plan and funding for implementation of sediment reduction actions?

- There are "synergies" that are possible from this project – e.g., leveraging other efforts at sediment reduction.

- Consider breaking down the LSMG into smaller geographically-based subcommittees for more focused input and increased participation.

Pre-Scoping Stakeholder Meetings

A series of pre-scoping stakeholder meetings and interviews with individuals was conducted at various locations in Oregon, Idaho, and Washington. The purpose of this effort was to provide participants with an overview of the project, and to solicit advice and information from government agency or other organizations' staff on local, sub-basin-scale sediment issues, data sources, and evaluation methods.

The meetings consisted of a presentation by Corps' staff, followed by questions and a discussion on local data sources and identifying knowledgeable individuals for follow-up communication. In addition to the meetings, individuals representing key organizations were interviewed. A set of questions was provided to the participants to solicit additional information and contacts. This information request focused on identifying sources of data and other information on sediment sources and routing through the stream system; efforts to manage sediment production; gaps in implementation of sediment control actions; and a query about their ability to participate in the on-going planning effort.

Similar to the Clarkston pre-scoping meeting, the stakeholder meeting participants noted that there are a number of sediment data sources available, though nothing that would constitute a comprehensive sediment budget for any of the sub-basins. Sediment source reduction is a priority in all of the sub-basins. The participants commented that there is more information on the implementation of sediment control measures and less data on sediment sources, delivery, and routing through the stream system. Where there are data on sediment sources and patterns, it is usually confined to a sub-watershed or stream reach. The participants noted that there are numerous opportunities to leverage existing sediment-reduction programs through cooperative efforts and cost sharing.

The following is a summary of the participants' identified issues and comments:

- The USFS is employing a number of sediment models (e.g., Water Erosion Prediction - WEPP) and ongoing application and research throughout the region. For this reason, it will be important to understand these on-going efforts and possibly use these models or information that has been generated.

- There are a number of sediment related research studies that focus on particular subbasins (e.g., the Palouse).

- Government agencies, including the Conservation Districts and NRCS, and subbasin organizations, such as the Grande Ronde Model Watershed, have identified sediment source areas, particularly roads, and are actively implementing sediment control measures such as road closures and drainage improvements.

- Sediment reduction is a priority for most of the organizations, with most actions focused on a "holistic" approach, including addressing resource management (e.g., proper grazing practices) and upslope measures such as proper drainage structures.

- Many of the streams within the affected region have completed stream inventory information, which is a source of data on in-channel sedimentation.

- A number of participants noted that there are limited data sets that show the direct relationship between sediment reduction actions and reduced sedimentation in streams. Some participants commented that it would be helpful to have demonstration projects that show the relationship between land management measures and sediment control.

Public Scoping Meetings

Public scoping open houses and meetings were held at four locations in the region: Clarkston; Washington on February 15; Boise, Idaho on February 21; La Grande, Oregon on February 22; and Portland, Oregon on February 27. The scoping meetings consisted of an afternoon and an evening session. The afternoon session was an open house format, during which display boards of the project area and project issues were set up in the conference room and Corps personnel and consultants were available to discuss the project and answer questions informally. The evening session included an introduction and a presentation by Corps' staff, followed by opening of the floor for comments and questions from attendees.

The following is a summary of the participants' identified issues and comments:

- There are concerns about the possible relationship between dredged sediment deposition in the Lower Snake River and habitat/fisheries impacts in the shallow water areas, including water temperature increases.

- Participants commented that it is necessary to capture all of the benefits of sediment reduction and not just benefits (environmental and related to commercial interests) in the Lower Snake River. There is a need to understand the economic benefits of sediment reduction in tributary systems.

- There were a number of questions about the funding mechanism for implementation of the final plan.

- There are concerns that sediment deposition in the river channel is increasing the risk of flooding within Lewiston. Will the EIS cover flood risks from sediment deposition?

- Participants had a number of questions about sediment management (including costs) and deposition patterns within the Lower Snake, in particular related to the dams and the port facilities, and relative contributions of sediment from the tributaries (e.g., the Clearwater).

- There were questions about how the Corps will evaluate sediment budgets, including movement through the tributaries and the dam complex.

- Many of the participants acknowledged that successful implementation of a sediment plan will require unprecedented cooperation from land management agencies and other organizations.

Written Scoping Comments

The public and agencies were encouraged to submit written scoping comments via comment cards, U.S. Mail, fax, or e-mail through the Corps' website. The Corps received twenty-one written comments from the following:

1 Federal agency
1 state agency
2 conservation districts
1 county advisory committee
1 city
2 ports
2 organizations
11 private citizens.

The written comments were separated into several general themes. These themes are listed below from those mentioned most frequently to those mentioned less frequently.

- Do not raise the levees at Lewiston. The existing levees cut off the city from the river.

- Support using measures to reduce sediment from upland sources. Instead of conducting more studies, provide funding to implement the measures already identified in subbasin plans.

- Support using a watershed approach and managing sediment as a resource in the river. Need to include more forest management and agricultural practices in the alternative measures.

- Use sediment modeling to answer several questions – determining source of sediment, forecasting sediment delivery into the Snake River, predicting future maintenance dredging needs.

- The Corps needs to coordinate this plan with Federal, State, and Tribal land management agencies and invite them to participate as cooperating agencies.

- Provide better flood protection for Lewiston. Do this through more dredging, providing free flood insurance, or buying out downtown.

- Do more dredging. Use dredging to maintain the authorized navigation and to provide flood protection for Lewiston.

- Future sediment evaluation needs to follow the Regional Sediment Evaluation Framework.

- The PSMP needs to look at a longer timeframe than 20 years. Seventy to 100 years would be more realistic and would address the time it may take to see results as well as addressing the end of the life of the dams.

- The PSMP needs to address impacts on water quality, Endangered Species Act-listed species, Tribes, and low income or people of color communities.

- Assess cumulative impacts across the various land ownership jurisdictions and consider appropriate mitigation strategies.

- Include a monitoring program to assess impacts and effectiveness of the measures and explain how the results will be used to modify future actions.

- Breach the four lower Snake River dams and improve railroads and highways to provide transportation of goods.

- Sediment management approaches should be looked at from a cost-effectiveness aspect.

- Do not relocate commercial navigation, recreation or water intake facilities.

- Draw down the reservoir in the spring to move sediment.

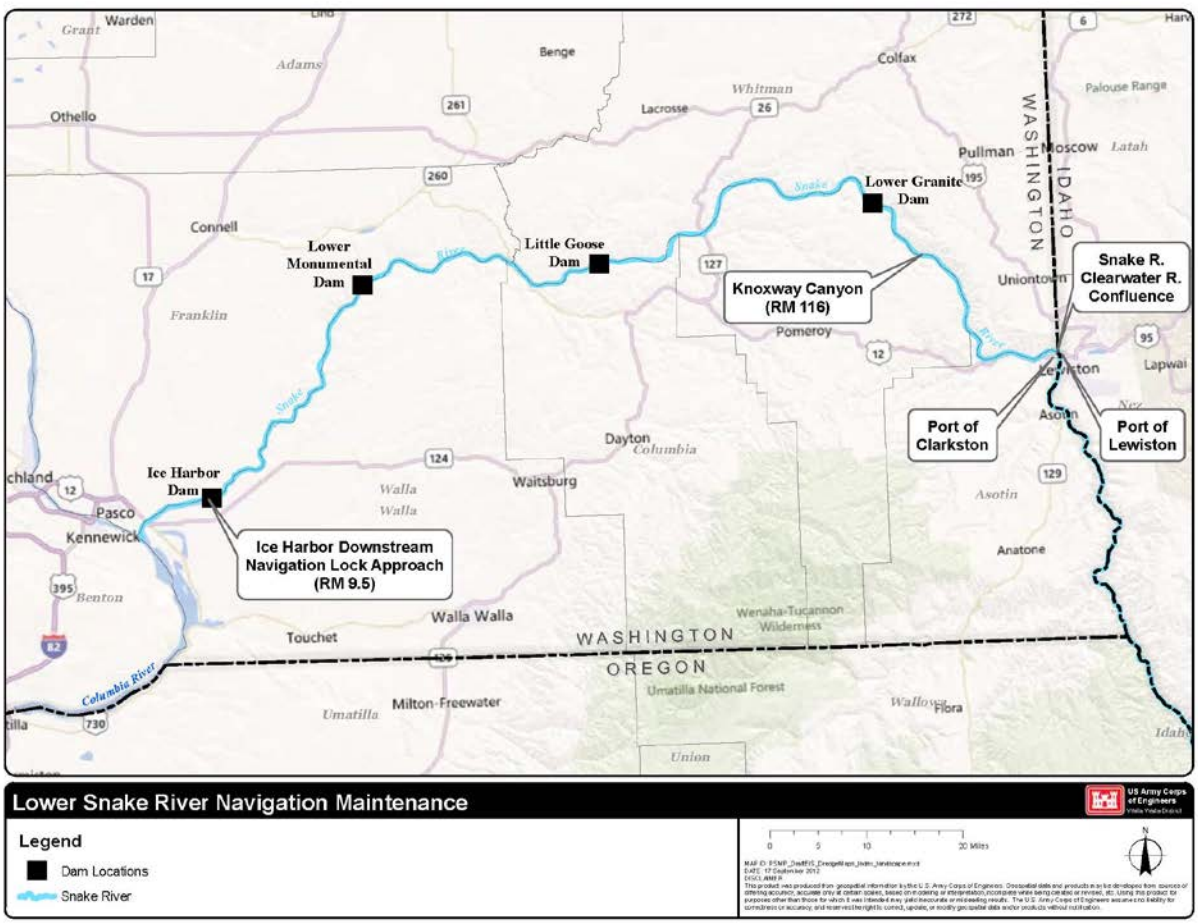
Lower Snake River Programmatic Sediment Management Plan Environmental Impact Statement

Appendix H: Summary of Proposed 2013/2014 Dredging

1 INTRODUCTION

The Corps proposes to perform maintenance dredging to meet the immediate need to provide a 14-foot depth as measured at minimum operating pool (MOP) at four locations in the lower Snake River and lower Clearwater River in Washington and Idaho (Figure 1). One site is the downstream navigation lock approach for Ice Harbor Dam (Snake RM 9.5), while the other three sites are located at the confluence of the Snake and Clearwater rivers in Lower Granite reservoir. The three sites in Lower Granite are the Federal channel (Snake RM 138 to Clearwater RM 2) and the berthing areas for the Port of Lewiston (Clearwater RM 1-1.5) and Port of Clarkston (Snake RM 137.9 and 139). The Corps identified a location in the Lower Granite reservoir, Snake River Mile (RM) 116 just upstream of Knoxway Canyon, as the preferred in-water discharge site of the dredged materials. The Corps proposes to use the dredged material to create additional shallow water habitat for juvenile salmonids subject to funding.

Figure 1. Project area map



Because routine navigation channel maintenance has not occurred since 2005-2006, shoaling in the channel and port berthing areas has become critical in these four locations. Sediment has been depositing in these areas in the Snake/Clearwater confluence primarily during spring runoff periods. Survey results from August 2011 show that the total surface area of the Federal navigation channel having depths less than 14 feet, as measured at minimum operating pool (MOP) in the Snake/Clearwater river confluence area has risen from approximately 38 acres in 2010 to about 50 acres in 2011, an increase of 31 percent. Water depths in the Federal navigation channel at the confluence are now as shallow as about 7 feet while the berthing areas at the Port of Clarkston and Port of Lewiston are now as shallow as 7.3 feet and 9.3 feet, respectively, based on a MOP water surface elevation. Navigation channel depths less than 14 feet substantially impact access to port facilities.

Shoaling in the Ice Harbor navigation lock approach is interfering with the ability of barge traffic to safely maneuver when entering or exiting the navigation lock. Spill flows at the dam have scoured rock from the base of the four rock-filled coffer cells bordering the lock approach and have pushed material from the edge of the lock approach into the channel, narrowing the room available for barges to maneuver between the coffer cells and the north shore. At least one of the coffer cells has been losing rockfill through the exposed base and this may be contributing to the material encroaching in the lock approach. This material has created a shoal that encroaches across the south half of the lock approach for about 480 feet, reducing the depth to about 9 feet at MOP in McNary pool (the lock approach is within McNary reservoir, not Ice Harbor reservoir).

Under the proposed action all dredging and disposal action would occur during the in-water work window from December 15 to March 1. This in-water work window was established through coordination with state and Federal resource agencies as the time period in which in-water work could be performed with the least impact to ESA-listed salmonid stocks.

Dredging would be aimed at restoring the navigation channel to the authorized depth by dredging to a depth of no more than 16 feet as measured at MOP. The overdepth dredging (i.e., to 16 feet) is standard procedure as outlined in Engineer Regulation 1130-2-520, *Project Operations – Navigation and Dredging Operations and Maintenance Policies* (Corps 1996). Overdepth allowance helps minimize the need for more frequent and intermittent dredging of high spots. A 16-foot depth is used as the maximum dredging depth in the Federal navigation channel in order to maintain a consistent 14-foot depth. Of the additional 2 feet, 1 foot is considered advance maintenance, which is the additional depth and/or width specified to be dredged beyond the project channel dimensions for the purpose of reducing overall maintenance costs and impacts by decreasing the frequency of dredging. The other foot is considered allowable overdepth, which is the additional depth below the required section specified in a dredging contract, and is permitted because of inaccuracies in the dredging process (Corps 1996).

Table 1 lists the sites proposed for immediate dredging and the estimated quantities of material to be removed from each site. Sediment is expected to continue to accumulate at these locations while this action is being planned, therefore the amount of material to be removed at the time of the dredging will likely be greater than what is shown in the table. The Corps anticipates the quantity of material needing to be dredged will range from 422,000 cy to a maximum of 500,000 cy.

Table 1. Sites Proposed for Immediate Maintenance Dredging

Site to be Dredged	Quantity to be Dredged (cy)[1]
Federal navigation channel at confluence of Snake and Clearwater Rivers (Snake RM 138 to Clearwater RM 2)	406,595
Port of Clarkston (Snake RM 137 and 139)	10,220
Port of Lewiston (Clearwater RM 1-1.5)	3,000
Ice Harbor Navigation Lock Approach (Snake RM 9.5)	1,950
Total	**421,765**

Note: 1. Based on removal to 16 feet below MOP using survey data from November 2011.

2 Sites for Maintenance Dredging

<u>Confluence of Snake and Clearwater Rivers (Federal navigation channel)</u>. About 407,000 cy of material would be removed from the Federal navigation channel at the confluence of the Snake and Clearwater Rivers (Figure 2a and 3).

Figure 2. Shoaling at the confluence of the Snake and Clearwater Rivers (may replace this with map from Robert)

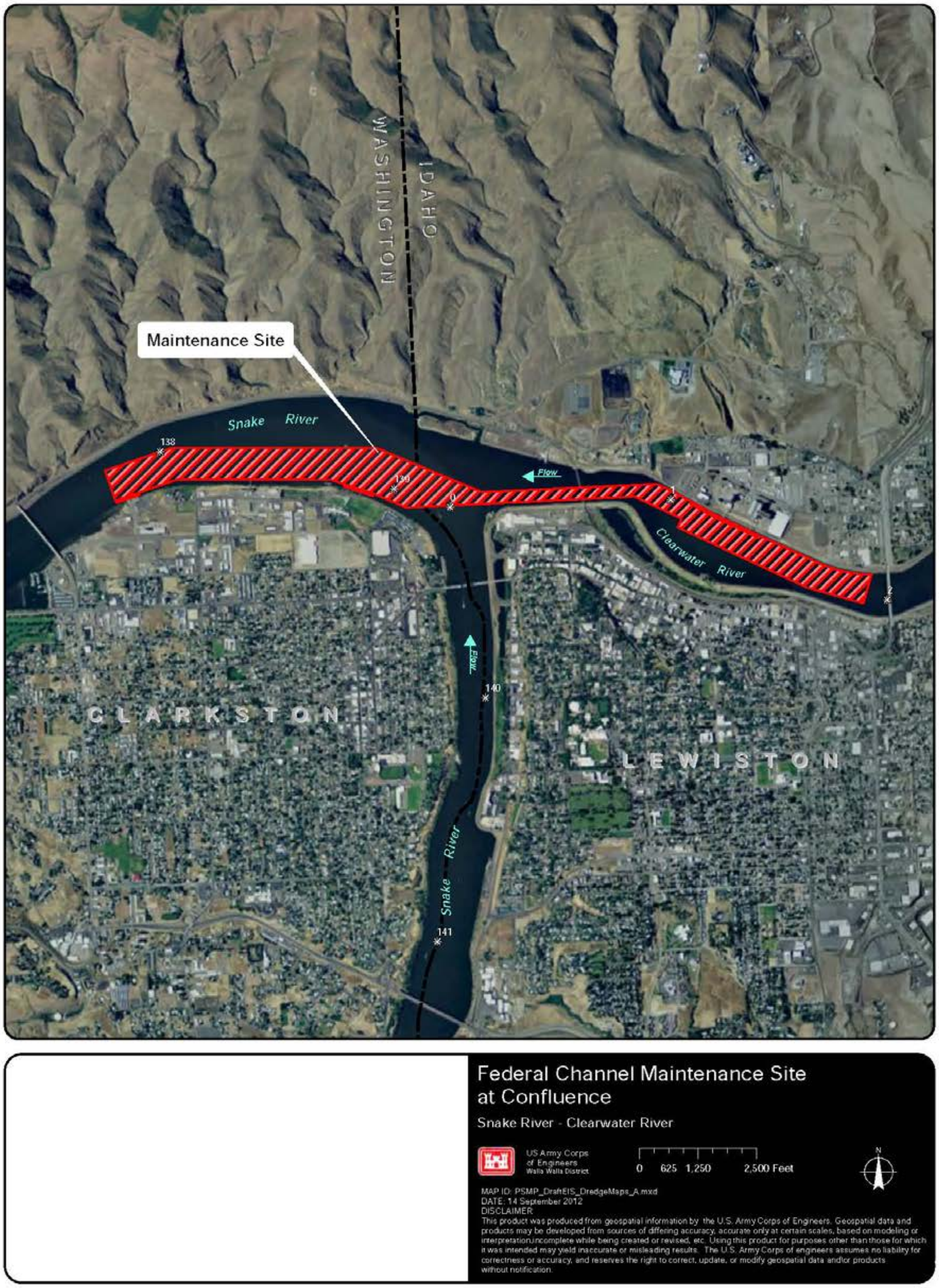
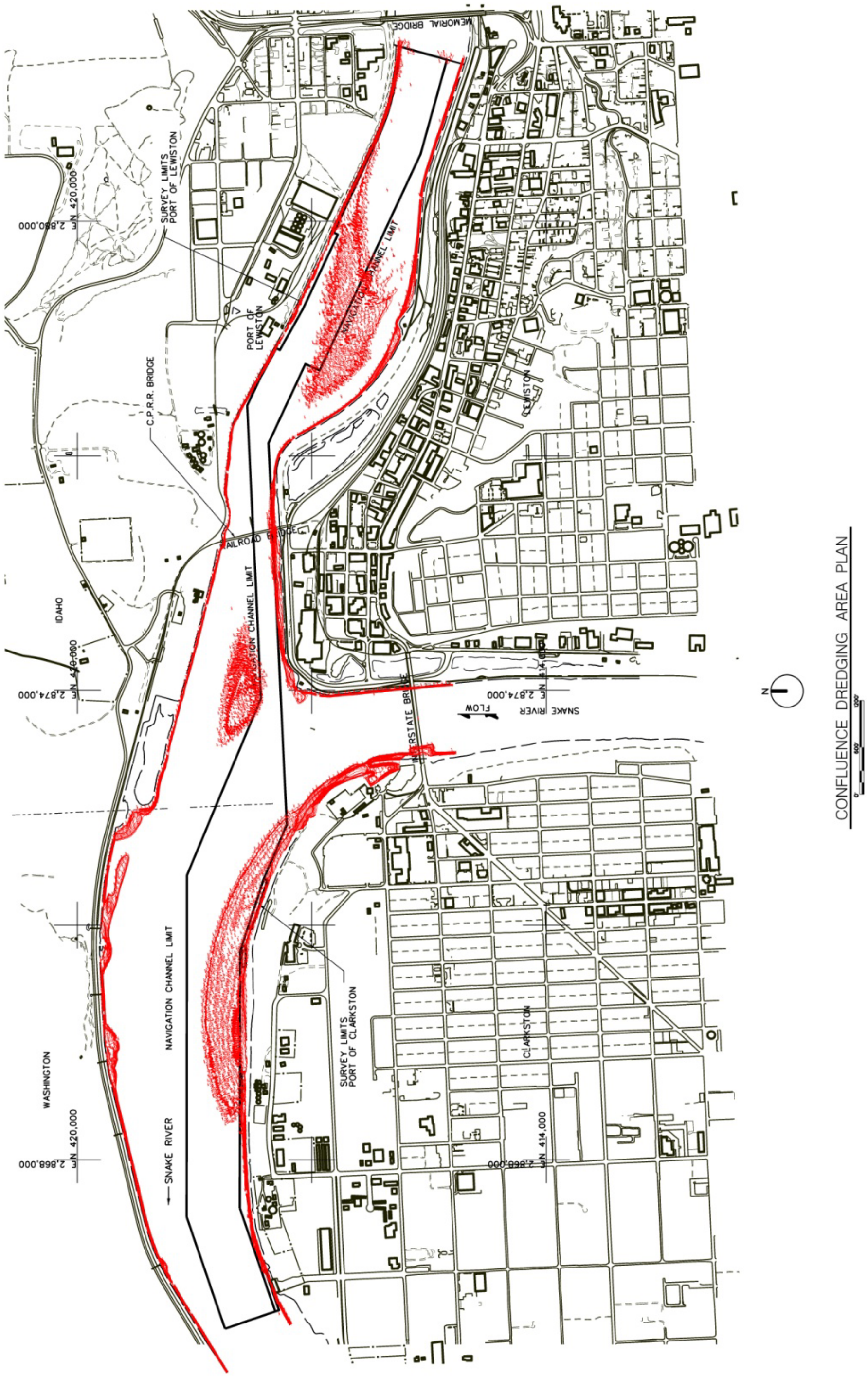


Figure 3. Shoaling locations at the Snake/Clearwater Rivers confluence. Areas less than 14 feet deep at MOP are in red.



Currently at locations in front of port berthing areas, the Federal navigation channel is expanded up to a maximum total width of 950 feet. This widening is provided to allow for maneuvering of barge tows in accordance with navigation practice described in 33 U.S.C. § 562, "Channel dimensions specified shall be understood to admit of such increase at the entrances, bends, sidings, and turning places as may be necessary to allow for the free movement of boats."

Sediment samples were collected in August 2011 from the main navigation channel in the confluence area. The average percent sand and fines (i.e., small particles of sediment, generally silts and clays) from the 2011 samples was 100 percent and 0 percent, respectively.

Port of Clarkston. About 10,220 cy of material would be removed from two berthing areas at the Port of Clarkston, the crane dock at the downstream end of the Port property (RM 137) and the tour boat dock at the upstream end (RM 139) (Figure 4). The berthing area is defined as a zone extending 50 feet out into the river from the port facilities and running the length of the port facilities. Maintenance in this area is the port's responsibility, and the Port of Clarkston would provide funding to the Corps for this portion of the work. Most of the area was last dredged in 2005/2006. Sediment surveys in 2011 showed that sediment composition was primarily of 86- to 99-percent sand and 1- to 14-percent fines.

Port of Lewiston. About 3,000 cy of material would be removed from the berthing area at the Port of Lewiston (Figure 5). The berthing area is defined as a zone extending 50 feet out into the river from the port facilities and running the length of the port facilities. Maintenance in this area is the port's responsibility, and the Port of Lewiston would provide funding to the Corps for this portion of the work. The area was last dredged in 2005/2006. Sediment surveys in 2011 showed that sediment composition was similar to that found at the Port of Clarkston.

Figure 4. Port of Clarkston dredging area

Figure 5. Port of Lewiston Dredging Area

Ice Harbor Lock Approach. About 1,950 cy of material would be removed from the Ice Harbor lock approach (Figures 6 and 7). Dredging has not occurred in this area since the 1970's. Sediment sampling showed that sediment composition was large rock substrate and cobbles greater than or equal to 2-6 inches.

Figure 6. Dredging location at Ice Harbor navigation lock approach.

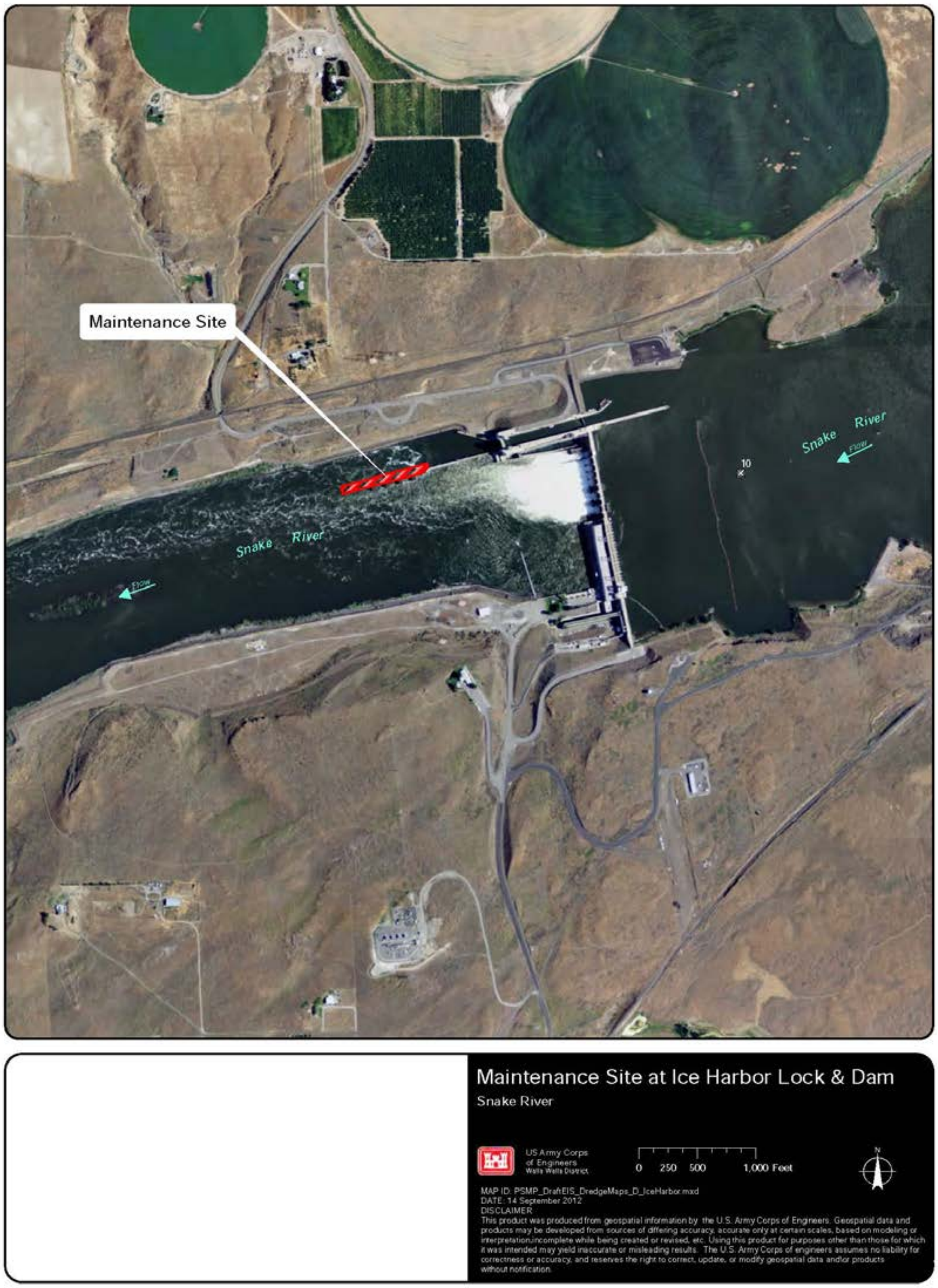
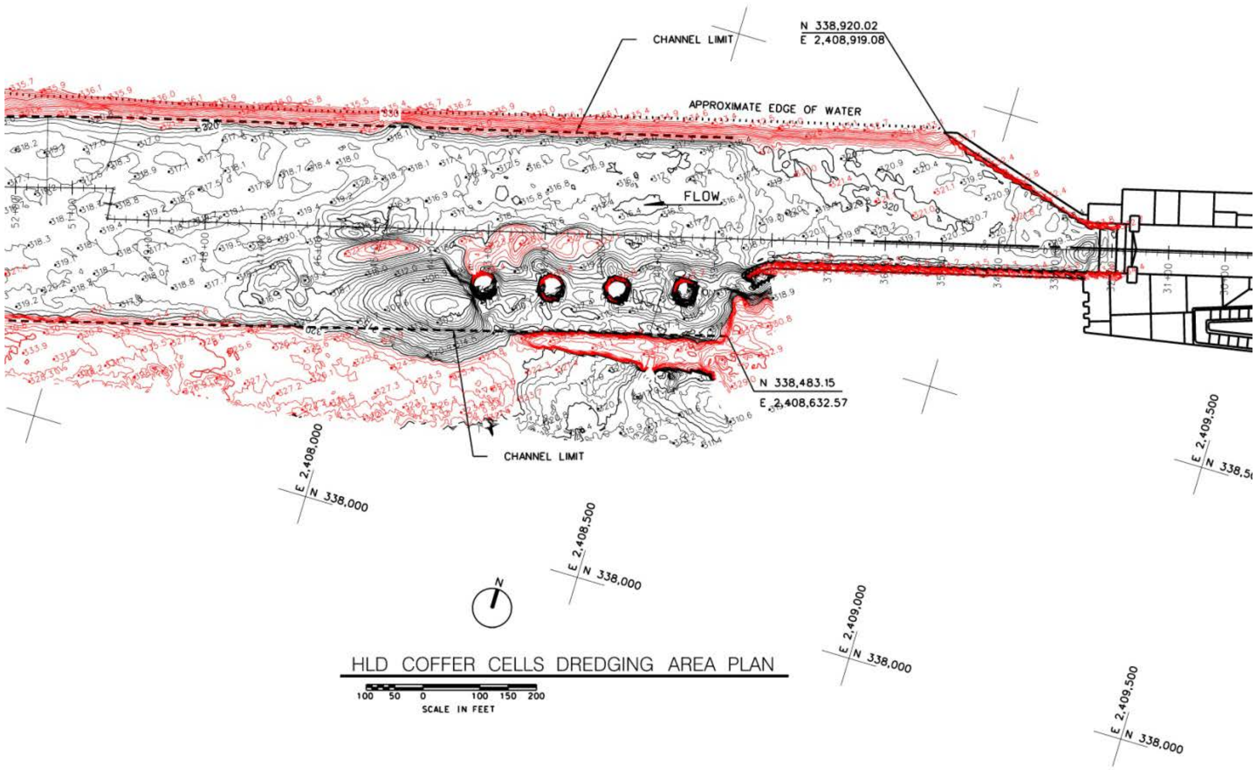


Figure 7. Shoaling at Ice Harbor navigation lock approach. Areas less than 14 feet deep at MOP are in red.



3 Dredging Methods and Timing

Dredging would be accomplished by a contractor using mechanical methods, such as clamshell, dragline, or shovel/scoop. Based on previous dredging activities, the method to be used would likely be clamshell. Material would be dredged from the river bottom and loaded onto barges for transport to the disposal site. Clamshell dredges with a capacity of approximately 15 cy and barges with capacity of up to 3,000 cy and maximum drafts of 14 feet would be used. It would take about 6 to 8 hours to fill a barge. The expected rate of dredging is 3,000 to 5,000 cy per 8-hour shift. The contractor could be expected to work up to 24 hours per day and 7 days per week. Material would be scooped from the river bottom and loaded onto a barge, most likely a bottom-dump barge. While the barge was being loaded, the contractor would be allowed to overspill excess water from the barge, to be discharged a minimum of 2 feet below the river surface.

Once the barge was full, a tug would push it to the disposal site. Once unloaded, the barge would be returned to the dredging site for additional loads. All dredging would be performed within the established in-water work window (December 15 through March 1). Multiple-shift dredging workdays would be used when necessary to ensure that dredging was completed within this window.

4 Disposal Options for Dredged Material

Disposal options for dredged materials are indentified in accordance with Corps regulations (33 CFR 335-338). The "Federal standard" for disposal of dredged material is defined as "[T]he least costly alternatives consistent with sound engineering practices and meeting the environmental standards established by the 404(b)(1) evaluation process. . . ." (33 CFR 335.7). 33 CFR 336.1(c)(1) states, "[I]t is the Corps' policy to regulate the discharge of dredged material from its projects to assure that dredged material disposal occurs in the least costly, environmentally acceptable manner, consistent with engineering requirements . . .." Additionally, it is the Corps' policy to always consider beneficial use of dredged material when evaluating disposal options (Engineer Manual 1110-2-5026). Corps policy is also provided in the *Planning Guidance Notebook* (Engineer Regulation 1105-2-100), which states "When determining an acceptable method of disposal of dredged material, districts are encouraged to consider options that provide opportunities for aquatic ecosystem restoration." The Corps considered (in addition to in-water disposal to create aquatic habitat – explained below) upland disposal to restore terrestrial habitat and upland disposal for port and industrial purposes. Such uses are not the least costly option and would require a request (and agreement) by a state/local governmental entity to cost-share in the project. The Corps has not received any request or expression of interest in such beneficial use projects.

4.1 Upland Disposal.

Because of concerns expressed by fish managing agencies and Tribes in the past about in-water disposal for previous maintenance dredging proposals, the Corps considered the option of upland disposal. The Corps identified two possible upland disposal sites–Joso and Wilma. These sites had been identified as potential upland disposal sites for the 2002 *Dredged Material Management Plan/Environmental Impact Statement* (Corps 2002a).

4.1.1 Joso.

Joso is a former borrow site located along the southern shore of the Lower Monumental reservoir at RM 57. Dredged material disposal would be confined to the limits of the existing borrow site, which encompasses about 80 acres and would be used to reclaim a portion of the borrow site. The added opportunity to restore terrestrial habitat is associated with this site. Upland disposal at the Joso site would require construction of barge off-loading facilities at the west end of the site. A sheet-pile barge slip would be constructed into the uplands to minimize disturbance to shallow-water habitat. A 14-foot-deep channel would be dredged to provide access to the slip. Two moorage dolphins would be installed along the entrance channel for temporary barge staging while waiting for unloading. This off-loading was considered because land access to the site is problematic due to current land usage (e.g., nearby railroad), especially for large quantities of material. An 80-acre retention pond would be constructed adjacent to the barge slip for dewatering dredged material prior to transport to the final disposal site. Cranes would off-load dredged material from barges into the retention pond. Trucks would transport dredged material from the pond to the disposal area. Disposed material would be compacted and shaped to conform to original site contours. Restoration of terrestrial habitat would be completed by placing 6 inches of topsoil on top of the dredged material and seeding this area with native plants, thereby creating a vegetative cover. Any trees or shrubs would likely be watered during the first growing season using a temporary irrigation system. The Corps would monitor the survival of the plantings and reseed or replant as necessary. Upland disposal at Joso would require additional dredging to prepare the off-loading site for use and would impose delays due to construction of the upland facilities and in-water work windows. Costs for upland disposal at Joso were projected to run 2 to 3 times higher than those of in-water disposal. These costs would include site development costs as well as the additional transportation costs associated with barging the material about 80 miles downstream from the site of most of the dredging. The time needed to barge the material to Joso would also affect costs as more equipment and personnel would likely be needed to accomplish the dredging within the in-water work window.

4.1.2 Port of Wilma

The Corps considered another upland disposal site, the Port of Wilma. The Wilma site would be at the downstream end of the Port of Wilma on the north shore of the Snake River at RM 134. The Corps used the Wilma site for dredged material disposal in 1986. At that time, the Corps constructed a series of three settling ponds to contain material from a hydraulic dredging action. The Corps filled only one cell and a portion of a second cell. In the past, the Port has expressed an interest in obtaining more dredged material to fill the remaining cells. However, the Port has been preparing the second cell for development without additional fill material, and the Corps has determined that the remaining cell may have a capacity of about 60,000 cy, which is not enough to contain the up to 450,000 cy of material that would be involved with this alternative. This option does not satisfy engineering requirements.

4.2 Open Water Disposal

Open water disposal would consist of transporting the dredged material by barge to a location downstream of River Mile (RM) 120 and releasing the material into the river at a site that would not impact the navigation channel or other project purposes or have an unacceptable impact on environmental resources. Material would need to be released downstream of RM 120 to avoid affecting the water surface elevation at the confluence of the Snake and Clearwater Rivers. Material placed in-water upstream of RM 120 raises the water level in the upper portion of the reservoir and impedes the ability of high flows to move through the channel. This diminishes the capability of the channel to pass high flows at the confluence and increases the flood risk at Lewiston, Idaho. Downstream of RM 120 the channel is deeper and the addition of material does not affect surface water levels.

Open-water disposal is estimated to be the least costly option, but has some environmental concerns in the lower Snake River reservoirs. Placing dredged material in mid-depth or deep water would have an effect on habitat for white sturgeon and would create habitat for species that prey on Endangered Species Act (ESA)-listed salmonids. Placing material at those depths would not provide any benefits for the ESA- listed species as the juveniles of those species use shallow water to rest and rear during their outmigration.

4.3 In-water Disposal to Create Habitat

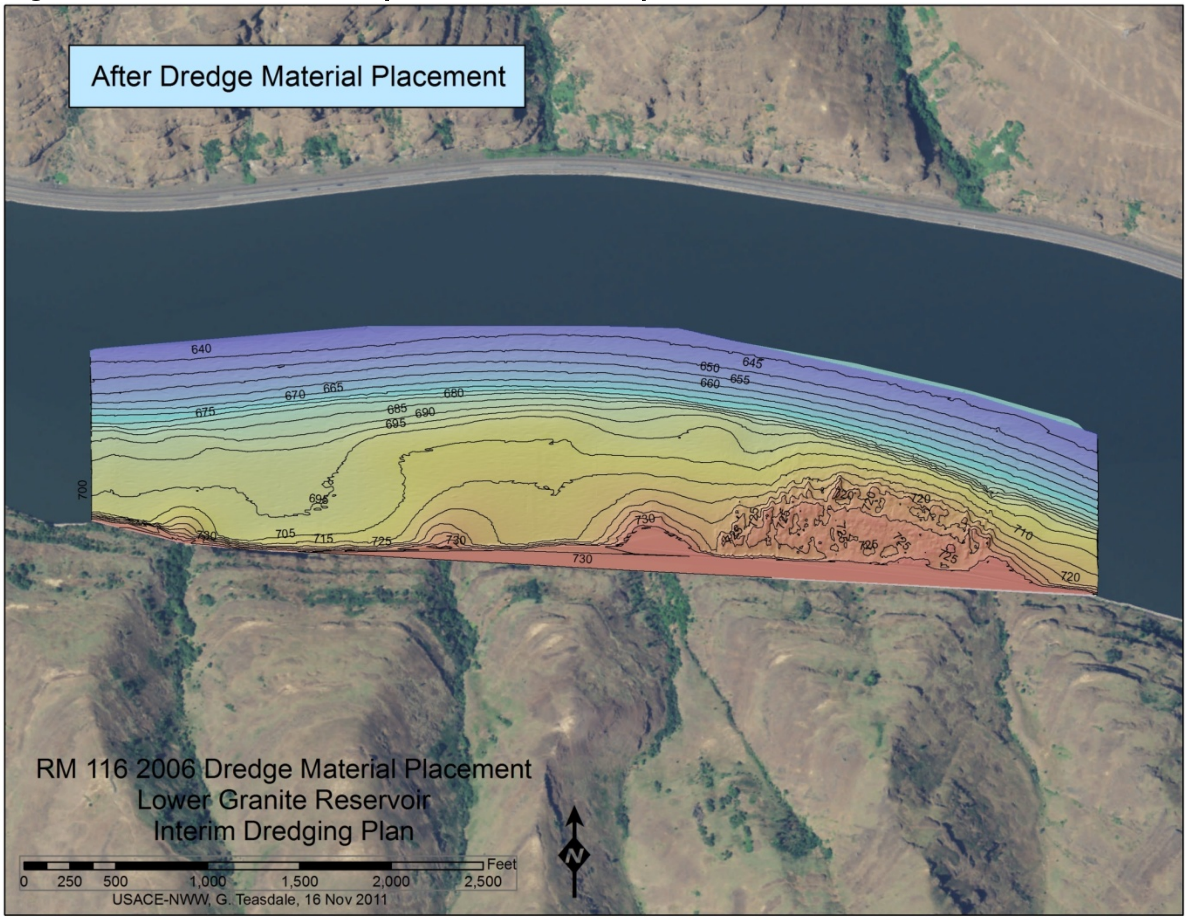
Prior to 1988, the Corps dredged the accumulated sediment from problem areas and disposed of the material either upland or in the reservoirs (open-water disposal). The Corps ceased open-water disposal in the 1980's as several Snake River salmonid stocks were proposed for listing as threatened or endangered under the ESA and regional fisheries managers opposed continued use of this disposal method. The concern was that open-water disposal had an adverse effect on salmonids and white sturgeon and provided potential salmonid predator habitat. In the late 1980's and early 1990's, the Corps funded a series of studies that evaluated these effects of in-water disposal. The studies indicated in-water disposal could be beneficial to juvenile salmonids and not create habitat for predators if certain design criteria were used to guide sediment disposal methods. Since 1997, the regional fisheries managers have provided qualified support for shallow water disposal as long as the Corps performs the disposal using design criteria from the most recent research. For its most recent disposal actions (1997/98, 1998/99 and 2005/06), the Corps has disposed of dredged material in-water to create shallow water habitat for juvenile salmonids with continued evaluation of the efficacy of these most recent in-water disposal actions.

Based on these research efforts within the lower Snake River, shallow-water disposal of dredged material has positively created resting and rearing habitat in the lower Snake River reservoirs for juvenile salmonids, primarily juvenile fall Chinook. This research has shown that the use of dredged materials to create shallow-water habitat within the photic zone of shoreline areas has not adversely impacted salmonid species and after stabilization provides suitable salmonid rearing (Artzen et al, 2012; Gottfried et el, 2011, Tiffan and Conner 2012). Newly built shallow water areas were found to provide beneficial shallow water habitat for juvenile salmonids particularly natural subyearlings during the spring and summer (i.e., rearing fall Chinook), minimized the presence of predators at disposal sites, were at least as productive for invertebrates as compared to reference sites, and in general made the reservoir environment more hospitable for the Chinook salmon using it (Artzen et al, 2012; Gottfried et el, 2011; Tiffan and Conner, 2012). This research supports the selection of natural fall Chinook subyearlings as the indicator group for determining the potential benefits of using dredged materials to create shallow water habitat, provides evidence against large-scale use of shallow water habitat by juvenile salmonids during the fall and winter, and suggests that creation of shallow water habitat be focused on creating narrow ribbons along the shoreline under 6 feet of depth. Based on this research and habitat modeling efforts in the Lower Granite pool, construction of additional salmonid rearing habitat in the lower Snake River should result in increased benefits to outmigrating juvenile salmonids, particularly Snake River fall Chinook salmon production and survival at the cohort and population levels. Currently, most juvenile fall chinook rearing habitat in the Lower Granite Pool is located in the upper half of the reservoir (i.e., upstream of Centennial Island, RM 120) and little currently exists in the lower half due to steep lateral bed slopes and unsuitable substrate along the shorelines. Because subyearling fall Chinook salmon are shoreline oriented and transient during rearing, creating new habitat in the lower portion of Lower Granite Reservoir in narrow ribbons along the shoreline should provide the greatest benefit based on recent field observations and analysis of currently available Snake River fall Chinook habitat.

Additionally, the ESA requires the Corps to consult with the USFWS and NMFS (collectively "Services") on any federal action that could jeopardize the continuing existence of endangered or threatened species or adversely affect critical habitat. During prior dredging consultations in the late 1990's and 2005, and preconsultation for this dredging action, the Services expressed qualified support for in-water disposal to create habitat for juvenile salmonids (beneficial use) based on findings of the most recent research. While in-water disposal provides the greatest benefit to juvenile fall Chinook as described above, all outmigrating juvenile salmonids should experience at least some benefit from shallow-water disposal of dredge materials. This includes Snake River spring/summer Chinook, fall Chinook, sockeye, steelhead, and bull trout. Snake River spring/summer Chinook, sockeye, and steelhead in the lower Snake River reservoirs tend to be more transitory and pelagically oriented utilizing deeper portions of the shallow water disposal sites (6-20 feet depth) while sub-yearling fall Chinook tend to be more shoreline oriented utilizing shoreline areas under 6 feet. The Corps has prepared a biological assessment (BA) proposing in-water beneficial use of the dredged material in the proposed action to create habitat for ESA- listed species, subject to availability of funds.

The proposed in-water disposal for habitat development site is located in the Lower Granite reservoir at Snake RM 116 and was selected for its proximity to dredging locations while meeting engineering and biological criteria. This site is an approximately 120-acre mid-depth bench on the left bank of the Snake River about 0.5 river miles upriver of Knoxway Canyon. The Knoxway site was historically an old homestead orchard and pasture located several hundred feet upland of the historic river shoreline. The beneficial use site is located in a low velocity area that has been accumulating sediment at an estimated rate of 2 inches per year since the filling of Lower Granite reservoir. The substrate at this site was visually inspected in 1992 during the reservoir drawdown test and was observed to be primarily silt. The upstream end of the site was used as the in-water disposal site for the 2005/2006 navigation maintenance dredging. Approximately 420,000 cubic yards of sand and silt was deposited on the upriver end of the Knoxway bench. An estimated 3.7-acre shallow water habitat shelf was created for summer rearing juvenile fall Chinook salmon (Figure 8). The upper surface of this material is sand that was reshaped to gently slope towards the river.

Figure 8. Contour map of RM 116 disposal site



The material from the proposed dredging would be deposited adjacent to and downstream of the material deposited in 2005-2006 (Figure 9). The new material would occupy a 26-acre footprint and would form a uniform, gently sloping shallow-water bench along about 3,500 linear feet of shoreline. The top of the bench would have a 2% slope and would provide about 7.36 acres of additional aquatic habitat up to 6 feet deep at MOP with features optimized for resting/rearing of outmigrating juvenile salmonids, particularly for fall Chinook salmon (Figures 10 and 11). The Corps anticipates there would be about 18 acres of lesser-quality shallow water habitat at depths of 6 to 20 feet on the slope of the bench.

Figure 9. Location of proposed disposal site at RM 116

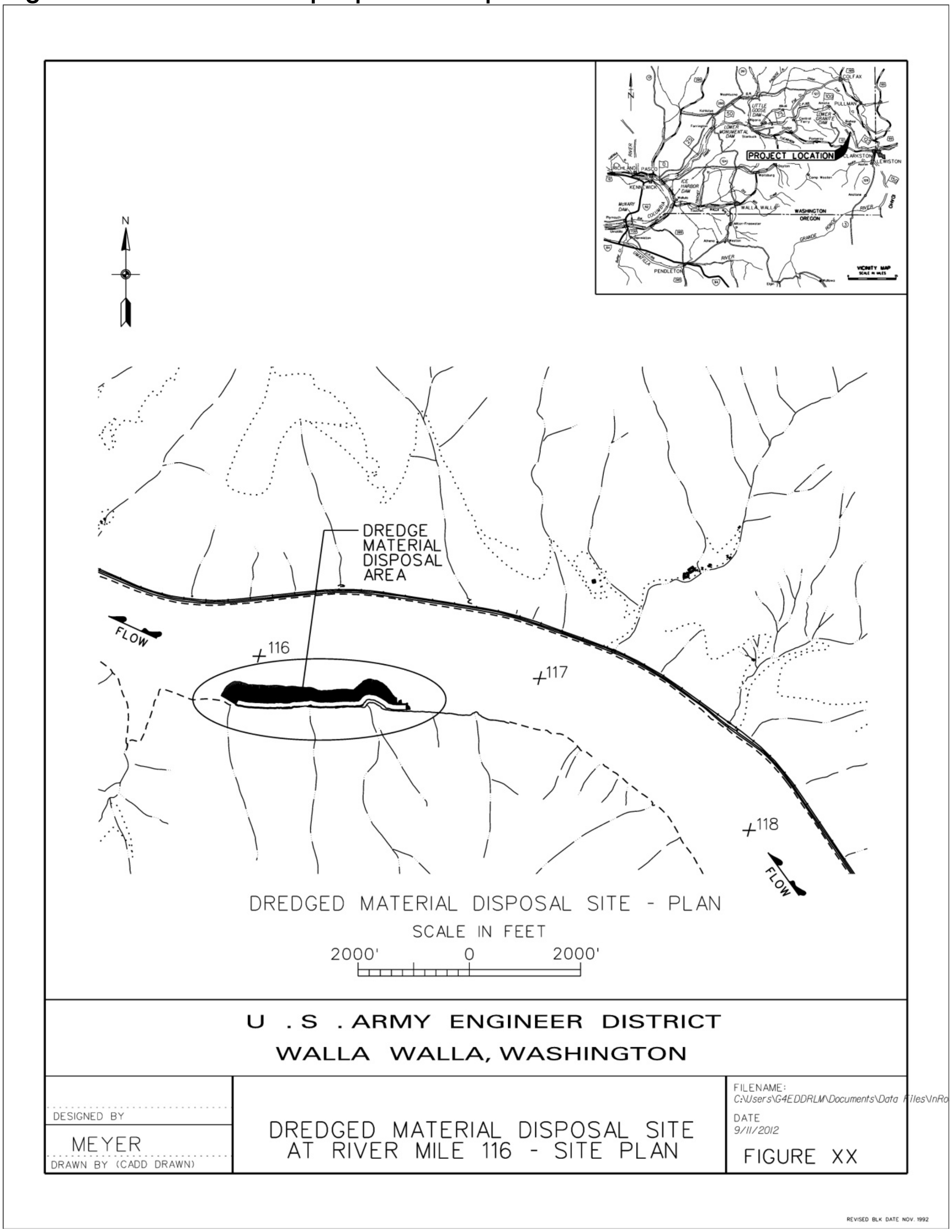


Figure 10. Site plan for disposal at RM 116

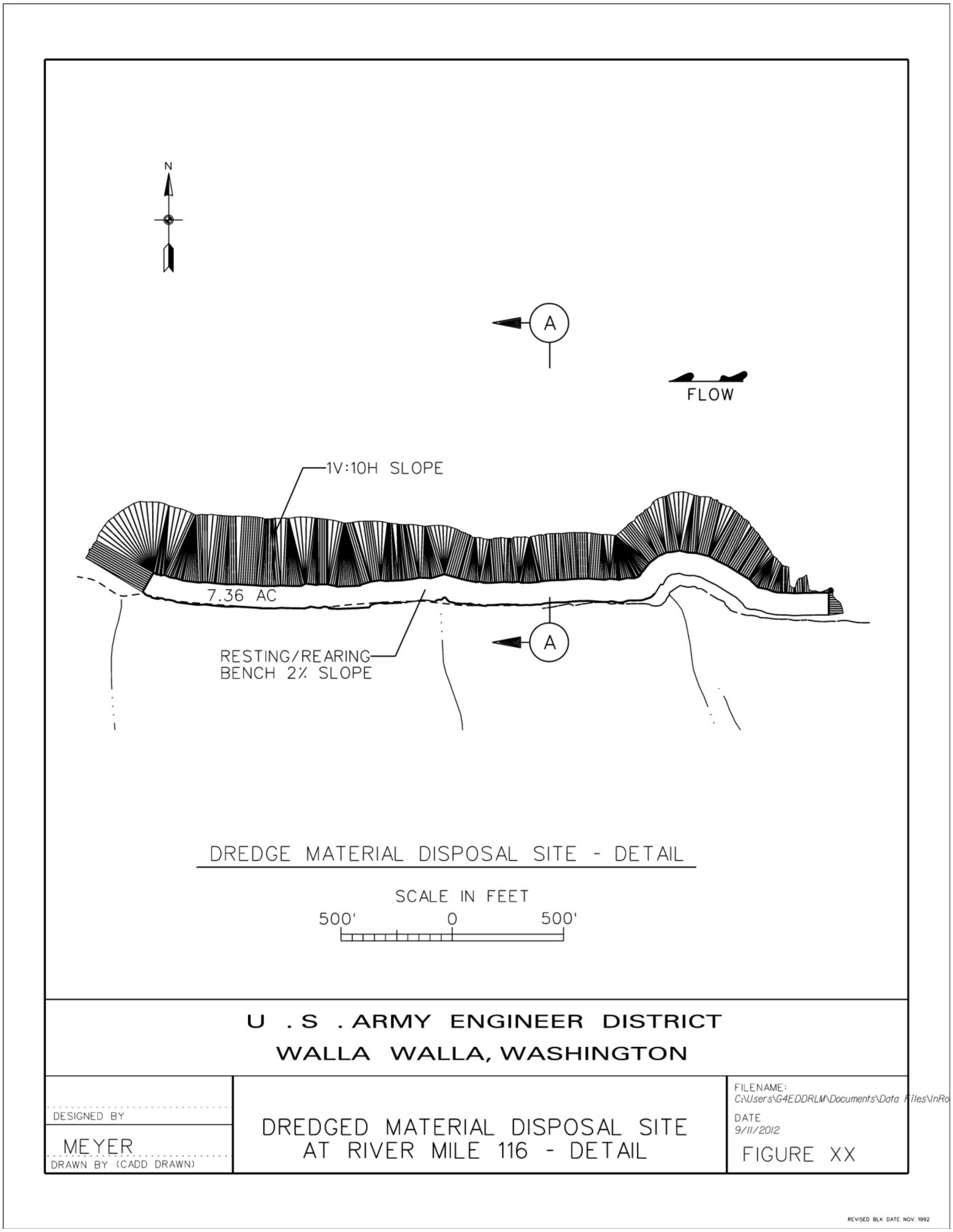
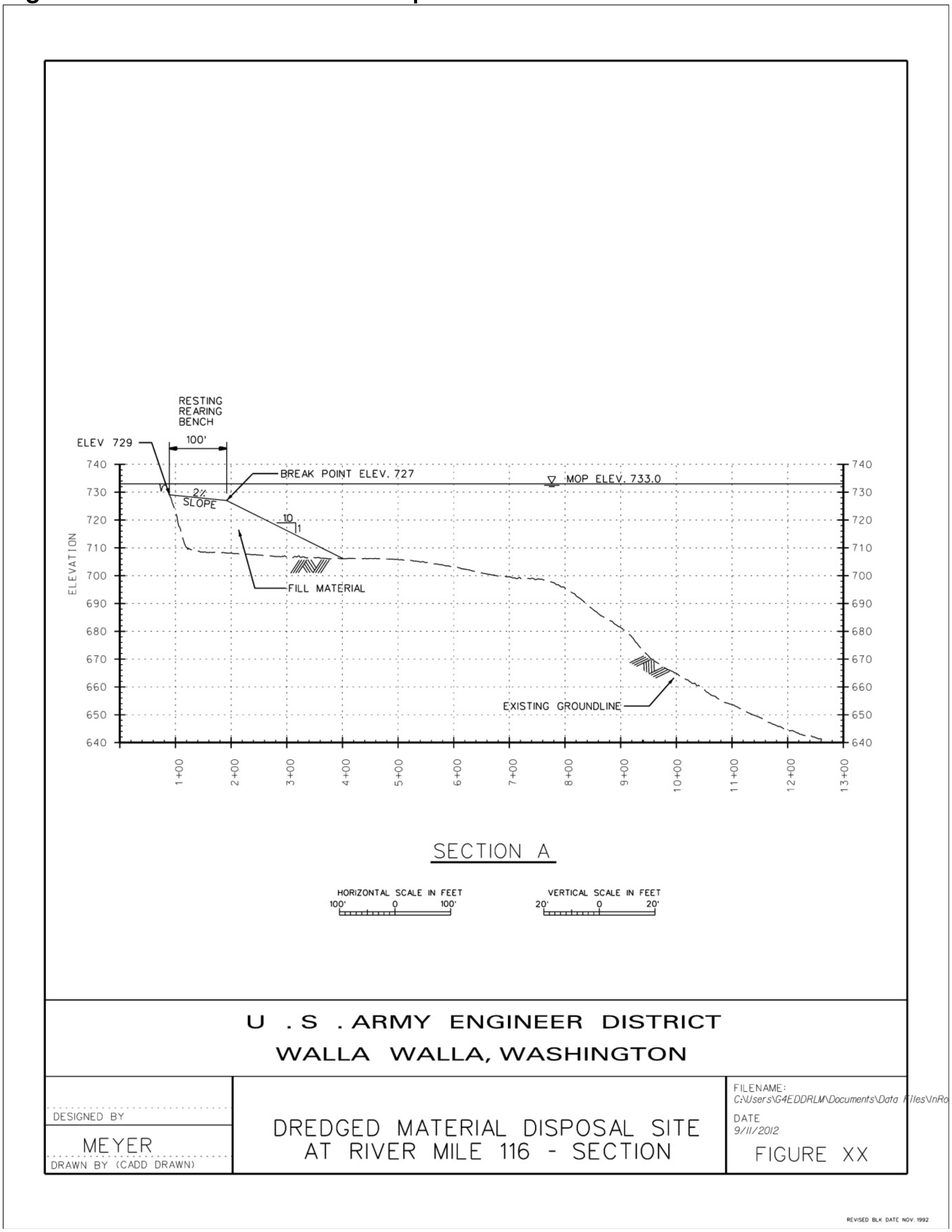


Figure 11. Cross section of disposal at RM 116



This site is close to the confluence where most of the dredging would occur. It is expected to provide suitable resting/rearing habitat for juvenile salmonids once the river bottom is raised, would not interfere with navigation, would not impact submerged cultural resources, and is of sufficient size to accommodate the anticipated dredged material disposal volume.

The overall plan is to place the dredged material in the below-water portion of the bench extending downriver from the material deposited in 2006 and riverward of the existing shoreline. However, rather than place the material in a block as was done in 2006, the Corps would place the material in a "ribbon" along the shoreline. This disposal approach is based on results of recent biological surveys (Tiffan and Connor 2012, Artzen et al. 2012). These results indicate that a more useful design for the shallow water habitat would be to place the sand and silt material into a narrow band with width of about 50 feet and surface plane depth of 6 feet at MOP elevation of 733 feet that parallels the shoreline. Placement of cobbles, rock, silt, and silt/sand mixture would occur in a manner that would extend the shore riverward along the proposed disposal site to enhance the rearing suitability of the mid-depth habitat bench, by creating a low horizontal slope across the newly created shallow-water rearing habitat. Final grading and/or reshaping to achieve the target slope would occur, if necessary, once disposal of all dredge material is complete.

The dredged material would be placed in steps. The first step would be to place the cobbles from the Ice Harbor lock approach either on the surface of the disposal site or along the outer edge of the planned footprint to form a berm. This would be followed by placement a mixture of the silt (less than 0.0024 inch in diameter), sand, and gravel/cobble, to fill the mid-depth portion of a site and form a base embankment. The dredged material would be transported by barge to the disposal area, where the material would be placed within the designated footprint. This footprint would be close to the shoreline, so that the river bottom could be raised to create an underwater shelf about 10 feet below the desired final grade. Because the barges may not be able to dump in the shallow depths, additional equipment would likely be needed to place or reshape the material to bring it up to the desired finished grade and slope. This may be accomplished by using hydraulic placement of material, which involves pumping the material from the barge through a pipe or hose to the surface of the disposal site and guiding the pipe so the material is placed where needed. It may also be accomplished by using equipment such as a clamshell bucket to move the material to meet the desired configuration.

The final step would be to place sand on top of the sand/silt embankment. An area of sand would be reserved as the final area to be dredged during the dredging activity. Sand would be placed on top of the base embankment in sufficient quantity to ensure that a layer of sand at least 10 feet thick covers the embankment once the final step of the process was completed. As described above, the sand could be placed using hydraulic placement or mechanical equipment. The final step includes placement or re-handling of the material to form a gently-sloping (3 to 5 percent) shallow area bench with water-ward edge depths down to 6 feet, finished on top of a stable base slope down to 20 feet deep, both measured at MOP. The sand cap layer would be created with a minimum thickness of 10 feet to ensure that the most desirable substrate (sand with limited fine-grained or silt material) was provided for salmonid-rearing habitat.

Monitoring embankment stability would be accomplished by performing hydrographic surveys soon after disposal was complete and periodically in the future to determine if the embankment slumped or moved. This information would be used to make adjustments in potential future dredged material placement, and to determine whether or not a berm should be constructed around the toe of the embankment to prevent movement. Monitoring of the biological use of the embankment would be accomplished by periodically sampling fish species in the area post construction. This information would be used to determine the efficacy of the disposal action for creating shallow water habitat to benefit ESA-listed species (e.g., juvenile fall Chinook) and would be used to make adjustments in methods for placing dredged materials as part of potential future dredging actions. The costs associated with this disposal option are estimated to be comparable to the costs of the open-water disposal option.

4.4 Preferred Disposal Option

In accordance with Corps regulations, the Corps has determined the least costly, engineeringly feasible and environmentally acceptable disposal option for this proposed immediate need action is open water disposal that does not interfere with authorized project purposes and does not have an unacceptable effect on environmental resources. However, beneficial use of the dredged material to create shallow-water resting/rearing habitat for juvenile salmonids at Knoxway Canyon (RM 116) is the preferred option and will be used subject to availability of funding. This approach is expected to have costs similar to open water disposal, would provide benefits to ESA-listed species, and is consistent with regional efforts and programs to recover those species. It is less expensive to implement than upland disposal to create terrestrial habitat at the Joso site. It also has the capacity to handle the quantity of dredged material anticipated with this immediate need action, whereas the Port of Wilma site does not have the needed capacity.

Appendix I: Lower Snake and Clearwater Rivers Sediment Evaluation Report for Proposed 2013/2014 Channel Maintenance

Prepared by USACE, 2012

Lower Snake and Clearwater Rivers Sediment Evaluation Report for Proposed 2013/2014 Channel Maintenance

Prepared by:

U.S. Army Corps of Engineers
Walla Walla District

September 2012

Abstract

This report summarizes the results of an August 2011 sediment sampling event for selected areas of the lower Snake River that may be dredged during winter 2013/2014. The original purpose of the study was to characterize sediment quality for the Walla Walla District Programmatic Sediment Management Plan (PSMP) and included locations outside of the proposed dredging template. As such, the only dredge material management units (DMMUs) evaluated in this report are the Port of Clarkston, the Port of Lewiston, a small portion of the Clarkston Bend, and the Ice Harbor Navigation Lock Approach. The sediment samples were analyzed for grain size, total organic carbon, percent solids, TAL metals, PCBs (Arochlors), semi-volatile organic compounds, polycyclic aromatic hydrocarbons, total petroleum hydrocarbons (diesel-heavy oil range), halogenated pesticides, organophosphorus pesticides, organonitrogen pesticides, phenylurea pesticides, carbamate pesticides, and glyphosate. The data was compared to the 2009 marine sediment criteria contained in the Sediment Evaluation Framework for the Pacific Northwest (SEF) and the Draft Washington State Department of Ecology (WDOE) 2012 sediment management standards (SMS) (While Draft, these proposed standards were used as a good indication of protectiveness in the freshwater environment). The Corps tested for many chemicals not on the standard list of chemicals of concern in the SEF, particularly pesticides, given the agricultural nature of the project area. Grain size data from the three DMMUs characterized the majority of the material proposed for dredging as sand with smaller amounts of silts near the mooring areas. The majority of the individual organic parameters were non-detectable. The approximately 420,945 cubic yards of sediment (does not include the Port of Clarkston crane dock) that are proposed to be dredged in 2013/2014 from the DMMUs included in this report met the criteria for unconfined open in-water disposal or beneficial uses.

Table of Contents

List of Figures

List of Tables

Appendices

WATER

APPENDIX B. LABORATORY RESULTS

PORT OF CLARKSTON DMMU

PORT OF LEWISTON DMMU

CLARKSTON BEND DMMU

1 BACKGROUND

The Walla Walla District of the U.S. Army Corps of Engineers (USACE) is currently identifying and evaluating sediment management strategies for the lower Snake River and proposes to adopt and implement a Programmatic Sediment Management Plan (PSMP) for the long-term management of sediment within the lower Snake River system to help the Corps meet authorized project purposes. The authorized purposes of the lower Snake River system include commercial navigation, hydroelectric power generation, recreation, and fish and wildlife conservation. Sediment accumulation in the lower Snake River can interfere with these authorized project purposes. The PSMP will provide information to support decision making about immediate need and future strategies for managing sediment deposition that interferes with authorized purposes of the lower Snake River. Physical and chemical sediment quality is a necessary component to evaluate these strategies.

As part of the PSMP process, a sediment evaluation of selected reaches of the lower Snake River was completed in 2011. The primary objectives of this study were to:

- Update the Districts sediment database and determine if there are significant changes to sediment quality conditions since previous testing.
- Compare this information to historical data collected from the same locations. Sediment samples have been collected from various locations within the lower Snake River since at least 1985. A summary of the physical and chemical characteristics is presented in the final Dredged Material Management Plan (DMMP) (USACE 2002b) and the Lower Snake River Juvenile Salmon Feasibility Report Environmental Impact Statement (USACE 2002a). More detailed information regarding specific studies can be found in Anatek (1997), CH2M Hill (2000, 1999, 1997), USACE (1987), Crecelius and Cotter (1986), Crecelius and Gurtisen (1985), HDR (1998), Pinza et al. (1992), and Heaton and Juul (2003).
- Determine the suitability of the sediment for proposed actions under the PSMP.
- Propose and support ranking of the Dredged Material Management Units (DMMUs) as prescribed in the 2009 SEF to determine frequency of testing requirements in support of future specific actions after completion of the PSMP study.

This report presents the results from the 2011 USACE sediment study that apply to areas that may be dredged during winter 2013/2014.

2 STUDY AREA

Two reaches within the lower Snake River, along with one in the Clearwater River, are considered in this report. The primary focus was Lower Granite Reservoir in the vicinity of the confluence of the Snake and Clearwater Rivers (Figure 1) since this is an area where sediment historically accumulates. This reach extends from approximately river mile 138 to 139.2 on the Snake River, and includes the Federal Navigation Channel and the Port of Clarkston. The first 1.5 miles of the Clearwater River is a second reach of interest that also includes the federal navigation channel as well as the Port of Lewiston. The third area of interest is the downstream navigation approach to Ice Harbor Dam near Snake River mile 9.6.

The area of proposed channel maintenance includes all, or part of, four DMMUs (Table 1). The estimated volumes of sediment that would be removed are presented in Table 2.

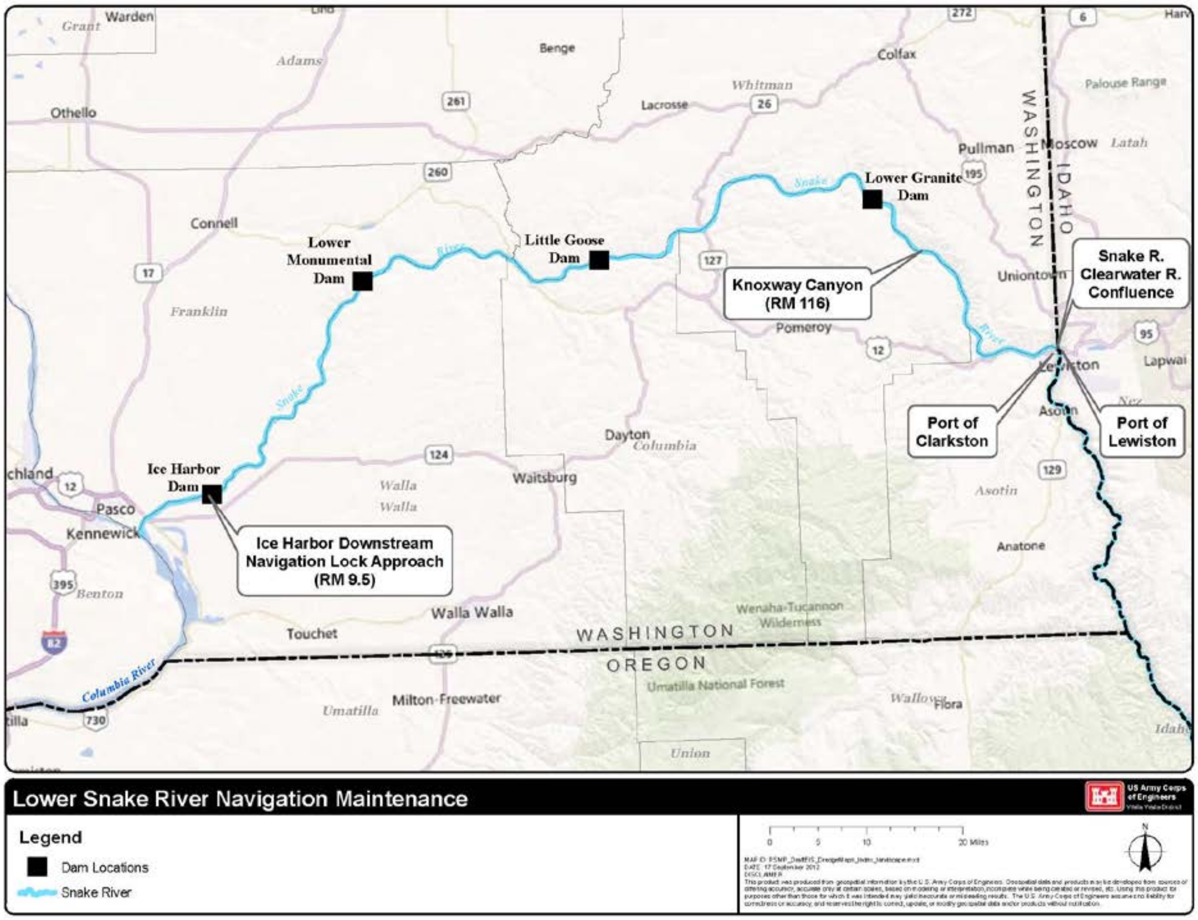


Figure 1. Locations of the four reaches of the lower Snake River basin that were sampled during 2011, along with the in-water disposal site at Knoxway Canyon.

Table1. Dredged Material Management Units included in the proposed channel maintenance project.

Name of DMMU	River Mile	Pool	County	State
Port of Clarkston	SR 138	Lower Granite	Asotin	WA
Port of Lewiston	CLW 1.5	Lower Granite	Nez Perce	ID
Clarkston Bend	SR 139	Lower Granite	Asotin	WA
Ice Harbor Navigation Lock Approach	SR 9	McNary	Walla Walla	WA

Table 2. Dredge quantities and substrate materials included in the proposed 2013/2014 channel maintenance.

Site to be Dredged	Quantity to be Dredged (cy)[1]	Type of Material
Federal Navigation Channel at confluence of Snake and Clearwater Rivers (Snake RM 138 to Clearwater RM 2)	406,595	Sand
Port of Clarkston (Snake RM 139)	9,400	Sand /Silt
Port of Lewiston (Clearwater RM 1-1.5)	3,000	Sand
Ice Harbor Navigation Lock Approach (Snake RM 9.5)	1,950	Cobble / Rocks
Total	420,945	

[1] = Based on removal to 16 feet below the minimum operating pool using survey data from November 2011.

3 SAMPLING DESIGN

Because the original purpose of the 2011 sediment-sampling program was to update the sediment quality database of the Clearwater and lower Snake Rivers for the PSMP, it did not focus on a specific dredging event. However, it did include areas where sediments have historically accumulated and have been dredged.

Several guidance documents were considered during the development of the 2011 sampling plan. These included Lombard and Kirchmer (2001), EPA (1995) Shelton and Capel 1994; WDOE (1992) and the Sediment Evaluation Framework (USACE 2009). One of the objectives used to develop the list of sample sites was to revisit locations that were sampled in 2003 where possible (Heaton and Juul, 2003). This approach was intended to facilitate construction of a database specific to sediment quality that can be used to establish DMMU ranking, as well complete long-term trend analyses of sediment chemistry in the reservoirs regardless of whether they may be dredged or not. Some of the previous sampling stations that were located at water depths greater than 14 ft were not included in the plan. However, there were also instances where additional locations were added within the dredge templates to ensure a thorough characterization.

Sediment quantities per DMMU were not available at the time of sampling, but estimates were made based on historical data and the assumption that the DMMUs near the confluence of the Snake and Clearwater Rivers would be low or low-moderate in ranking. The Ice Harbor Navigation Lock approach was assumed to have a very low ranking, since previous samplings consisted of cobbles and rock.

3.1 Sampling Locations

The subset of DMMUs and sample locations considered in this report are shown in Figures 2 through 5. The sample locations are associated with areas where dredging is proposed to occur during the winter of 2013/2014. Tables 3 through 6 provide the global positioning system (GPS) coordinates for each sample location, as well as the type of sample collected.

3.1.1 Port of Clarkston DMMU

The Port of Clarkston DMMU covers 3,397,011 square feet (sq ft) of the Snake River between River Miles 138 and 139.2 (Figure 2). The area with an elevation greater than 717 ft above mean sea level (amsl) is shown in red and indicates the segment of the DMMU that could be dredged. Ten sample locations were visited and seven of those resulted in a sample collection (Table 3). The remaining three did not result in a sample due to the sampler encountering a rock that prevented adequate penetration or insufficient sample retention.

Table 3. Sample locations in the Port of Clarkston DMMU

Sample Location	Date	Time	Actual Latitude	Actual Longitude	Water Depth	Type Sample
LGR138.4G	8/16/2011	1558	46 25.630 N	117 03.281 W	14.5	---
LGR138.4G2	8/20/2011	1700	46 25.632 N	117 03.280 W	16	Grab
LGR138.7G	8/16/2011	1615	46 25.630 N	117 03.282 W	14.8	---
LGR138.95K	8/16/2011	1528	46 25.562 N	117 02.639 W	12	Core
LGR138.95K2	8/18/2011	1122	117 02.639 W	117 02.638 W	12	Core
LGR138.9H	8/20/2011	1840	46 25.636 N	117 02.648 W	16	Grab
LGR138.9X	8/18/2011	1439	46 25.608 N	117 02.678 W	11	Core
LGR138.9Y1	8/16/2011	1539	46 25.596 N	117 02.789 W	5	---
LGR138.9Y2	8/18/2011	1056	46 25.597 N	117 02.789 W	6	Core
LGR139.1X	8/20/2011	1817	46 25.519 N	117 02.419 W	13	Grab

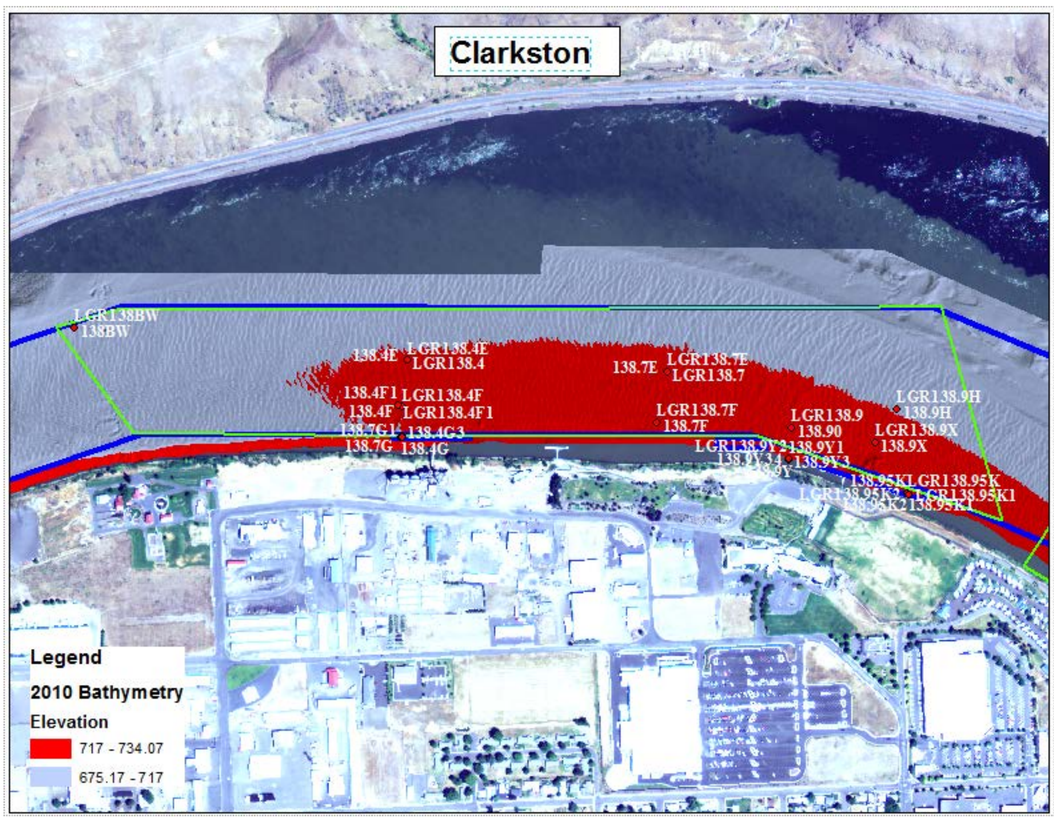


Figure 2. Port of Clarkston DMMU with sample locations and the region where sediment have accumulated above an elevation of 717 ft amsl.

3.1.2 Port of Lewiston DMMU

The Port of Lewiston DMMU covers 2,594,902 sq ft of the Clearwater River between River Miles 1.0 and 1.5 (Figure 3). The red shading again represents the area where the elevation is greater than 717 ft amsl and may be subject to dredging. Eleven sample locations were visited and eight of those resulted in sample collection (Table 4). Analogous to the situation at the Port of Clarkston DMMU, there were three locations where samples could not be retrieved due to encountering hard substrate or inadequate sample retention.

Table 4. Sample locations in the Port of Lewiston DMMU

Sample Location	Date	Time	Actual Latitude	Actual Longitude	Water Depth	Type Sample
CLW1.1A1	8/20/2011	1557	46 25.453 N	117 00.944 W	19	Grab
CLW1.1B	8/20/2011	1505	46 25.434 N	117 00.982 W	19	Core
CLW1.25A	8/16/2011	1705	46 25.394 N	117 00.777 W	14	---
CLW1.2B	8/19/2011	1145	46 25.360 N	117 00.799 W	13	Core
CLW1.2C	8/19/2011	1119	46 25.336 N	117 00.829 W	13	Core
CLW1.3A	8/16/2011	1716	46 25.350 N	117 00.677 W	14.8	---
CLW1.3A	8/19/2011	0815	46 25.351 N	117 00.686 W	18	Core
CLW1.3B	8/19/2011	1057	46 25.362 N	117 00.748 W	13	Core
CLW1.3C	8/19/2011	0930	46 25.330 N	117 00.775 W	13	Core
CLW1.4A	8/16/2011	1735	46 25.299 N	117 00.517 W	12	---
CLW1.4B	8/19/2011	0914	46 25.281 N	117 00.558 W	19	Core

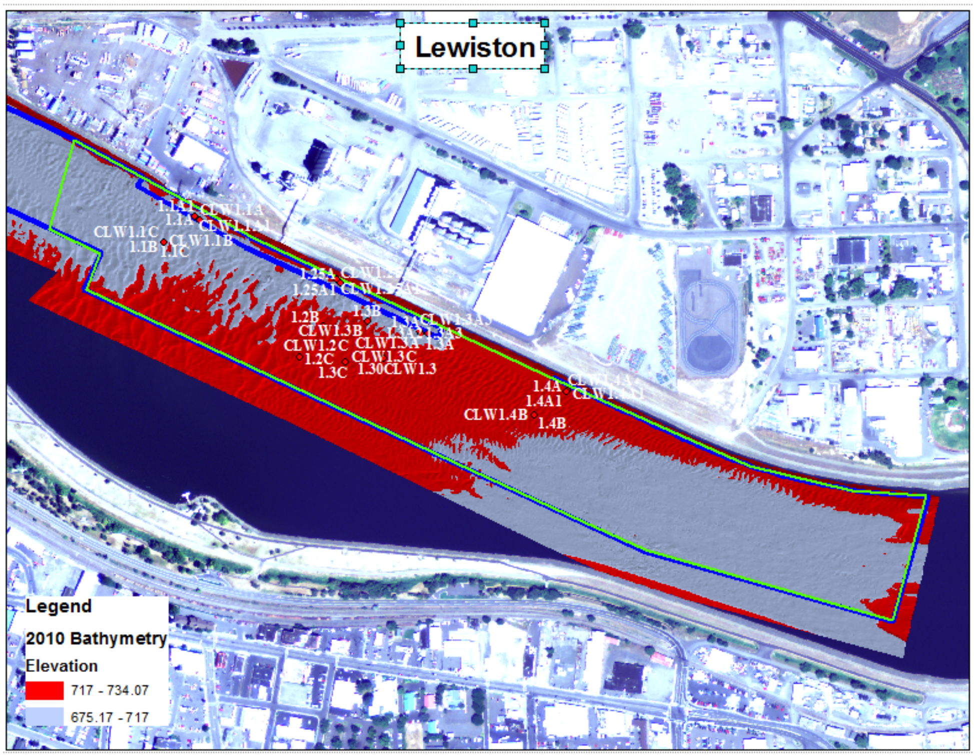


Figure 3. Port of Lewiston DMMU with sample locations and the region where sediment have accumulated above an elevation of 717 ft amsl.

3.1.3 Clarkston Bend DMMU

The Clarkston Bend DMMU covers 410,550 sq ft of the Snake River between river miles 139 and 140 (Figure 4). This reach of the river was identified as a potential source of additional sediment that could affect the frequency of dredging at the Port of Clarkston. Most of the DMMU is outside the dredge template proposed at this time. However, one sample was collected near the northern boundary of the DMMU, is within the proposed dredge template, and on the border of the area that is above an elevation of 717 ft amsl. As such, the information obtained from this sample is included inTable 5.

Table 5. Sample location in the Clarkston Bend DMMU

Sample Location	Date	Time	Actual Latitude	Actual Longitude	Water Depth	Type Sample
LGR139.1X	8/20/2011	1817	46 25.519 N	117 02.419 W	13	Grab

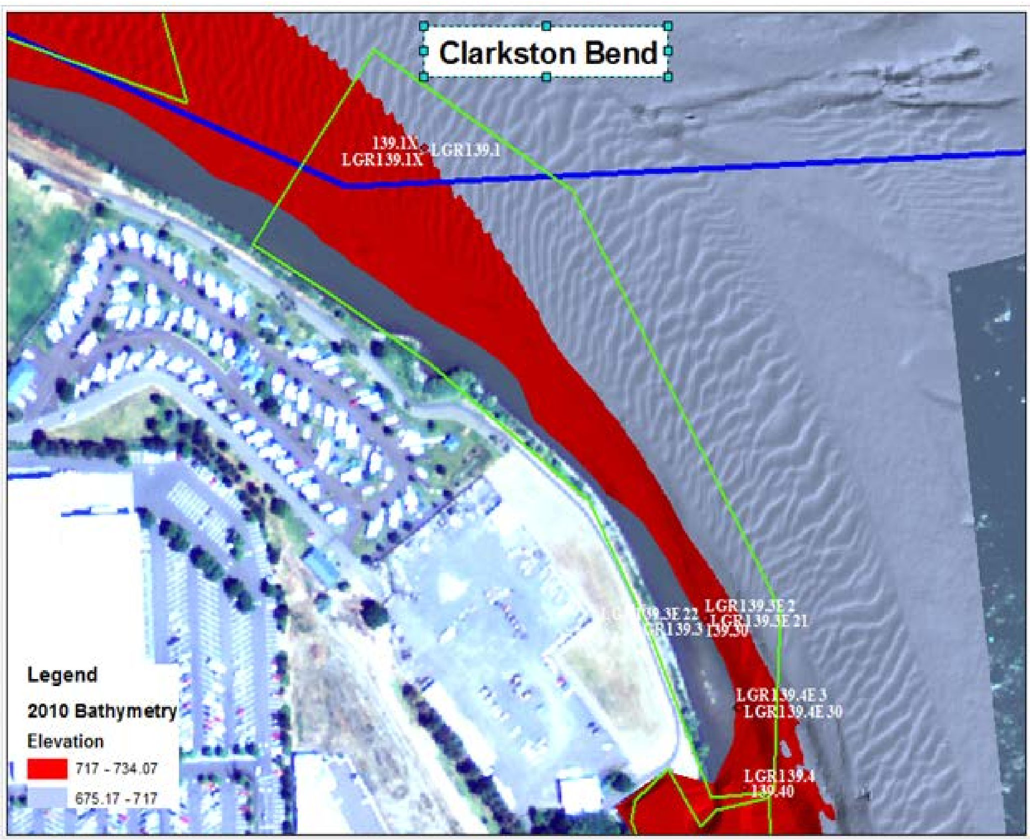


Figure 4. Clarkston Bend DMMU with sample locations and the region where sediment have accumulated above an elevation of 717 ft amsl.

3.1.4 Ice Harbor Navigation Lock Approach DMMU

The Ice Harbor Navigation Lock Approach DMMU covers 321,527 sq ft of the lower Snake River at approximately river mile 9.6 (Figure 5, Table 6). This area has been sampled and dredged in the past and has always yielded cobbles ranging in size from 1 to 10 inches, or more, in diameter with some sands but no silts. The grab samples retrieved during the 2011 field event again only yielded large material (see Figure 6 for an example) and no samples were forwarded to the laboratory for further analyses. However, photos were taken of the substrate material retrieved for documentation.

Table 6. Sample locations in the Ice Harbor Navigation Lock Approach DMMU

Sample Location	Date	Time	Actual Latitude	Actual Longitude	Water Depth	Type Sample
SRM9.6A	8/21/2011	1650	46.15.01	118.53.09	ND	Cobble/ rock
SRM9.6B	8/21/2011	1548	46.15.01	118.53.12	ND	Cobble/ rock
SRM9.6C	8/21/2011	1501	46.15.00	118.53.13	ND	Cobble/ rock

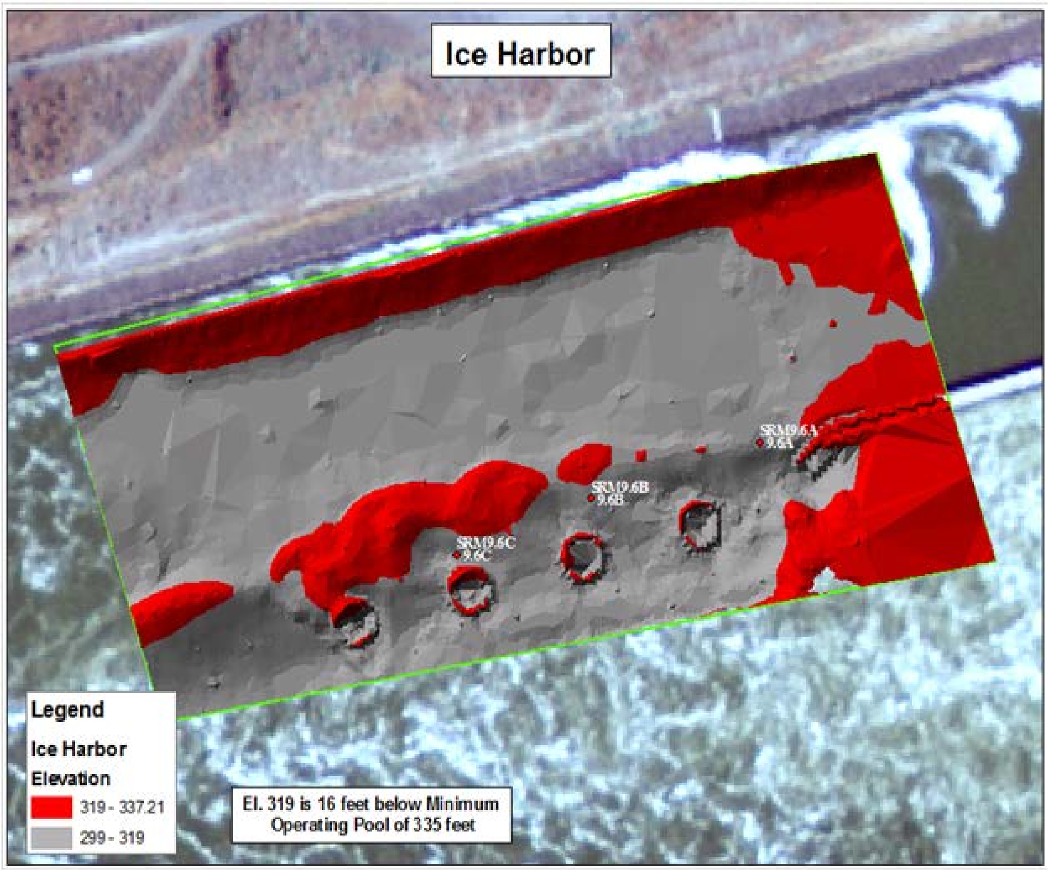


Figure 5. Ice Harbor Navigation Lock Approach DMMU with sample locations and the region where sediment have accumulated above an elevation of 319 ft amsl.

Figure 6. Representative material retrieved from the Ice Harbor Navigation Lock Approach DMMU.

4 FIELD PROCEDURES

The stations were located and positions recorded during the fieldwork using a differentially corrected global positioning system (DGPS) to within less than one foot of accuracy using WGS84 decimal degrees as the reference to a minimum of six decimal places. Where appropriate, positions relative to fixed onshore structures or features were recorded in the field notebook maintained during sampling. The contractor was allowed to shift location if the sampling gear was unable to collect a sample.

4.1 Sample Equipment Preparation

All core sampling tubes, core catchers, dredges, mixing bowls, spoons, and related tools that contacted the sediment were thoroughly cleaned prior to use. Pre-cleaning prior to initiating work at a sediment management unit consisted of washing with Liquinox or Alconox detergent, followed by sequential rinses with tap water, dilute (10 percent) reagent grade H_2SO_4 or HCl acid, de-ionized or distilled water, and finally with de-ionized water again. The equipment was then air-dried and wrapped in aluminum foil or protected in a sealed box, until used in the field. Cleaning between successive sampling stations within a designated area consisted of thoroughly washing with on-site water. Back-up sampling equipment and containers was available at all times.

4.2 Sediment Sampling

The majority of the sediment sampling was completed using a 4-in vibratory core sampler. The cores were driven to refusal, the sediments were retained in individual liners and capped, or placed in sealed buckets, and the contents were sectioned according to the on-site registered geologist's break points. Cores that yielded less than 1-foot of penetration to refusal were sampled with a hydraulically powered clamshell sampler. Areas that consisted primarily of rock or gravel were also sampled with the grab sampler. In either case, sufficient sample volume was collected to provide ample material for physical and chemical testing.

The depth of the cores retrieved from the Port of Clarkston and Port of Lewiston DMMUs were compared to the 16 ft maximum dredge cut line. All of the cores, with the exception of the one at CLW12.5A, penetrated the 16-ft dredge line and were later subsampled to bracket this boundary (Figure 7).

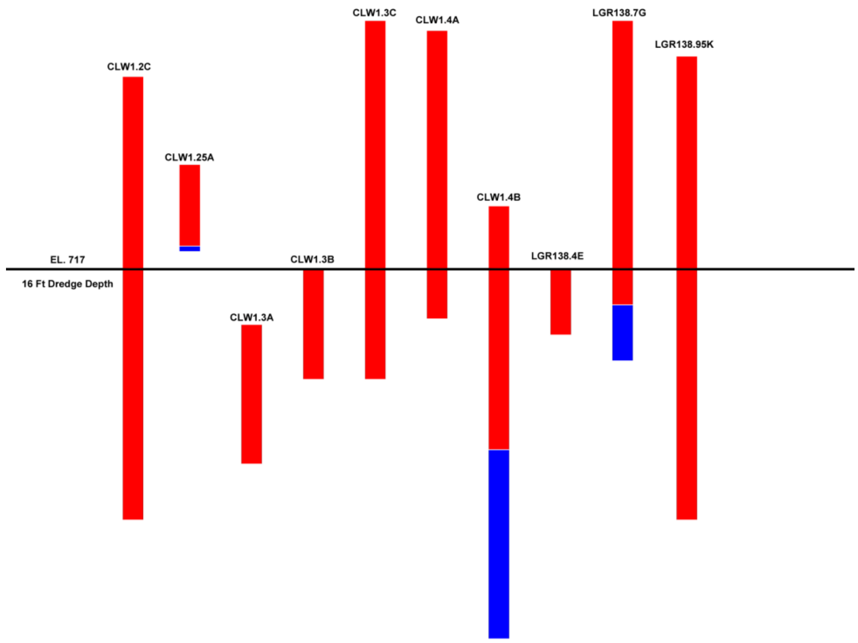


Figure 7. Depths of cores retrieved from the Ports of Clarkston and Lewiston DMMUs relative to the proposed 16-ft dredge depth.

4.3 Field Evaluation of Sediment Samples

Once the sample was brought back to the shore the contents of the sampler was visually examined, and photographed by a registered geologist. Sediment cores were split and physical characteristics were logged. If the sample contained primarily cobble and gravel material, it was photographed but not sent for laboratory analyses. However, a digital photo of the sample, along with a ruler and identification number, was taken for documentation.

The sediment samples retrieved at each target location that did not consist primarily of cobble or gravel were composited. This task consisted of placing the material in a large stainless steel bowl and mixing the contents with a stainless steel spoon until the mixture was homogeneous. The individual samples were removed and placed in appropriately sized and labeled sample containers. Chain of custody was maintained through the entire sample train from collection to analysis.

5 LABORATORY ANALYSES

The sediment and equipment blank water samples were analyzed using the methods identified in Table 7. The analytes included in each method are presented in Appendix A.

Table 7. Laboratory methods used to analyze the sediment and water samples.

Parameter	Sediment	Water
Sieve analysis	ASTM D422	NA
Total solids	APHA 2540G	NA
Total organic carbon (TOC)	EPA 9060	Standard Methods 5310B
Metals	EPA 6020A, 6010B	EPA 200.8
Mercury	EPA 7471B	EPA 245.1
Aroclors (PCBs)	EPA 8081	EPA 608
Herbicides	EPA 8151	EPA 615
Diesel and heavy oils	WDOE	NWTRH-Dx
Semi-volatile organics	EPA 8270-SIM	EPA 625-SIM
Polycyclic aromatic hydrocarbons	EPA 8270-SIM	EPA 625-SIM
Pesticides	EPA 8321B, 8181B, 8141B, 8270D, Monsanto,	EPA 8321B, 8181B, 8141B, 8270D, 547

6 QUALITY CONTROL AND QUALITY ASSURANCE

6.1 Field Quality Control and Quality Assurance

Additional QA/QC samples were collected in the field in association with the execution of this sampling and analysis plan. Sample types include duplicates, split samples, and equipment blanks:

- Duplicate samples were collected at a rate of at least 10 percent of the sample locations and submitted to the laboratory as a new sample location.
- Split samples were also collected and sent to a separate laboratory for the appropriate analyses.
- Washing the samplers with de-ionized water and submitting the water to the laboratory for the same chemical analyses prescribed for the sediments constituted an equipment blank.

6.2 Laboratory Quality Control

Laboratory quality control consisted of internal QA/QC and submission of scheduled performance evaluation samples as prescribed by the Washington Department of Ecology’s Accreditation Program. Prior to contract award, each laboratories accreditation was verified for each parameter and each test method. Laboratories submitted the following types of data:

- Percent Recoveries.
- Matrix spikes.
- Blanks.
- Calibration standard recoveries.
- Surrogate recoveries.
- Batch QA metrics.

6.3Third Party QA Audit

Data validation was conducted using the techniques described by PTI (1989a, b). The data validation was to QA-1 level and many of the procedures were evaluated to the QA-2 level, but the third part QA audit was at the QA-1 level (Kismet Scientific Services, 2012). This data quality review is available from Walla Walla District.

7 RESULTS

The results are summarized with a focus on positive detections only. Classes of constituents that were not detected are omitted from the results section tables. All classes of chemicals tested were retained as part of the results narrative for each DMMU section if there was a positive detection for that class of chemical. A dash in a table denotes that the compound was not detected at the minimum reporting level (MRL).

The results were compared against:

- The 2009 marine screening levels in the SEF (USACE 2009).
- The 2012 Draft freshwater *Sediment Management Standards* (SMS) proposed for the Washington Administrative Code (WAC) 173-204 (WDOE 2012). These proposed amendments were used as an indication of sediment suitability in the freshwater environment because the SEF does not have established freshwater screening levels. The SMS has undergone peer review and they are based on science and provide a good indication of protection. The SMS is currently undergoing a public review process so the numbers are subject to change or may not be adopted.

The applicable criteria are shown in shaded boxes next to the results columns in each table. Where there is no criterion for that benchmark, a dash is placed on the table denoting no comparative criterion.

7.1 Ice Harbor Lock Approach DMMU

Three samples were taken from this DMMU. All three samples yielded cobble and large rock and were not forwarded for physicochemical analyses.

7.2 Port of Clarkston DMMU

None of the results of the sediment analyses determined for the Port of Clarkston DMMU samples showed exceedences of the screening levels in the SEF or Draft SMS. Some of the highlights include:

- TOC ranged from 0.07 to 5.3 percent, and total solids were between 58.1 and 79.1 percent (Table B-1).
- Metals were analyzed in 5 of the 14 sediment samples (Table B-2). Metals concentrations were below any of the comparison criteria.
- Carbamate pesticides, halogenated pesticides, organophosphorus pesticides, organonitrogen pesticides, and phenylurea herbicides (Tables A-10 through A-13) were not detected.
- Three low level PAHs (i.e., benzo(a)anthracene, phenanthrene, and pyrene) were detected in concentrations ranging from 8.4 to16.2 ppb at one site, LGR138.95K2 (Table B-3).
- No diesel was detected in the sediment samples, but heavy oil residue was detected in core sample LGR138.95K2 at 86.0 ppm (Table B-4).
- Arochlor PCBs and semi-volatiles were not detected in the samples.

7.3 Port of Lewiston DMMU

The Port of Lewiston DMMU sample results are:

- TOC ranged from 0.06 to 0.38 percent, and total solids were between 73.4 to 88.0 percent (Table B-5). The data show that most of the material that would be removed during channel maintenance from this DMMU would be sands.
- Metals were detected at low levels, with aluminum detected at about 60 percent of the levels found in the Port of Clarkston DMMU (Table B-6). None of the metals were in excess of the 2009 marine SEF screening values and the 2012 Draft WDOE SMS standards.
- Carbamate pesticides, halogenated pesticides, organophosphorus pesticides, organonitrogen pesticides, and phenylurea herbicides were not detected.
- Ten PAHs were detected in the CLW1.2C sample, but all were below the screening levels (Table B-7).
- Petroleum hydrocarbons, Arochlor PCBs, and semi-volatiles were not detected in the sediment samples.

7.4 Clarkston Bend DMMU

Only one sample location (LGR139.1X) within the Clarkston Bend DMMU is within the dredging prism. The sample was 93 percent sand, 67.9 percent total solids, had a TOC content of 0.5 percent (Table B-8), and was not processed for chemical analyses.

8 DISCUSSION

This report presents the field methods, laboratory methods, and analytical results for the sediment samples that were collected during August 2011 in areas of the lower Snake River that may be dredged during winter 2013/2014. The results are evaluated using the 2009 SEF and 2012 Draft WADOE SMS guidelines to determine applicability for in-water disposal.

The sediments were analyzed for a suite of physicochemical parameters. Physical characterizations indicated that greater than 90 percent of the samples sent to the laboratory consisted of sand and theTOC content did not exceed 1.9 percent in any of the samples. The metals analyses showed that concentrations of sixteen elements did not exceed the 2012 Draft SMS or the 2009 Marine SEF screening limits. One hundred seventy-seven agricultural organic chemicals were evaluated using multiple EPA methods and none were detected in the sediment samples that were sent to the laboratory. Small amounts of PAHs and semi-volatile organic compounds were detected in the sediments at most locations, but again did not exceed the 2009 marine SEF screening limits or the 2012 freshwater SMS guidelines. Diesel was not detected in any of the samples, but heavy oil at a concentration of 86 mg/kg was detected in a Port of Clarkston sample; this is far below the 2012 freshwater SMS target set at 3,600 mg/kg.

Based on the results from this study, the sediments within the dredge template at the Port of Clarkston, Port of Lewiston, Clarkston Bend, and Ice Harbor Navigation Lock Approach proposed for 2013/2014 meet the chemical and physical criteria for open and unconfined in-water placement and beneficial uses. The guidelines provided by the 2009 SEF and the 2012 Draft freshwater SMS in WAC Chapter 173-204 indicate that there would be no biochemical impacts to listed fish species, pelagic zooplankton, or benthic macro invertebrates from the proposed action.

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APPENDIX A

ANALYTES INCLUDED FOR EACH LABORATORY METHOD

SEDIMENT ANALYSES

Table A-1. Metals Analyzed in 2011 by Method EPA 6020A

Element	CAS Number	Element	CAS Number
Antimony	7440-22-4	Copper	7440-50-8
Arsenic	7440-38-2	Lead	7439-92-1
Barium	1304-29-6	Nickel	7440-02-0
Beryllium	7440-41-7	Selenium	7782-49-2
Cadmium	7440-43-9	Thallium	7440-28-0
Chromium	7440-47-3	Zinc	7440-66-6

Table A-2. Metals Analyzed in 2011 Using EPA Method 6010B

Element	CAS Number
Aluminum	7429-90-5

Table A-3. Metal Analyzed in 2011 Using EPA Method 7471B (Cold Vapor)

Element	CAS Number
Mercury	7439-97-6

Table A-4. Aroclors (PCBs) Analyzed in 2011 Using EPA Method 8081

PCB	CAS Number	PCB	CAS Number
Aroclor-1016	12674-11-2	Aroclor-1248	12672-29-6
Aroclor-1221	11104-28-2	Aroclor-1254	11097-69-1
Aroclor-1232	11141-16-5	Aroclor-1260	11096-82-5
Aroclor-1242	53469-21-9		

Table A-5. Herbicides Analyzed in 2011 Using EPA Method 8151

Herbicide	CAS Number	Herbicide	CAS Number
2,4,-D	94-75-7	Dichlorprop	15165-67-0
2,4-DB	94-82-6	Dinoseb	88-85-7
2,4,5-T	93-76-5	MCPA	94-74-6
2,4,5-TP (Silvex)	93-72-1	MCPP	93-65-2
Dalapon	75-99-0	Picloram	1918-02-1
Dicamba	1918-00-9		

Table A-6. Diesel and Heavy Oils Analyzed in 2011 Using WDOE Method

Hydrocarbon	CAS Number	Hydrocarbon	CAS Number
Diesel	68476-34-6	Heavy Oil	90640-86-1

Table A-7. Semi-Volatile Organic Compounds Analyzed in 2011 Using EPA Method 8270-SIM

S-VOC	CAS Number	S-VOC	CAS Number
2-Methylphenol	95-48-7	Dimethylphthalate	131-11-3
2,4-Dimethylphenol	105-67-9	Di-n-butylphthalate	84-74-2
4-Methylphenol	106-44-5	Di-n-octylphthalate	117-84-0
bis(2-Ethylhexyl)phthalate	117-81-7	Pentachlorophenol	87-86-5
Butylbenzylphthalate	85-68-7	Phenol	108-95-2

Table A-8. PAHs Analyzed in 2011 Using EPA Method 8270-SIM

PAH	CAS Number	PAH	CAS Number
1-Methylnaphthalene	91-20-3	Benzo(k)fluoranthene	207-08-9
2-Methylnaphthalene	91-57-6	Chrysene	218-01-9
Acenaphthene	83-32-9	Dibenzo(a,h)anthracene	53-70-3
Acenaphthylene	208-96-8	Fluoranthene	206-44-0
Anthracene	120-12-7	Fluorene	86-73-7
Benzo(a)anthracene	56-55-3	Indeno(1,2,3-cd)pyrene	193-39-5
Benzo(a)pyrene	50-32-8	Naphthalene	91-20-3
Benzo(b)fluoranthene	205-99-2	Phenanthrene	85-01-8
Benzo(g,h,i)perylene	191-24-2	Pyrene	129-00-0

Table A-9. Pesticides Analyzed in 2011 Using EPA Method 8321B (HPLC/MS)

Pesticide	CAS Number	Pesticide	CAS Number
3-Hydroxycarbofuran	16655-82-6	Fenuron	101-42-8
Aldicarb	116-06-3	Flumioxazin	103361-09-7
Aldicarb Sulfone	1646-88-4	Imidacloprid	138261-41-3
Aldicarb sulfoxide	1646-87-3	Isoxaben	82558-50-7
Azoxystrobin	131860-33-8	Linuron	330-55-2
Bendiocarb	22781-23-3	Methiocarb	2032-65-7
Bensulide	741-58-2	Methomyl	16752-77-5
Boscalid	188425-85-6	Monuron	150-68-5
Bromacil	314-40-9	Neburon	555-37-3
Carbaryl	63-25-2	Oxamyl	23135-22-0
Carbofuran	1563-66-2	Propoxur	114-26-1
Carfentrazone-ethyl	128639-02-1	Pyraclostrobin	175013-18-0
Clothianidin	210880-92-5	Pyrimethanil	53112-28-0
DCPMU	3567-62-2	Siduron	1982-49-6
Diphenylamine	122-39-4	Sulfentrazone	122836-35-5
Diuron	330-54-1	Thiabendazole	148-79-8
Fenobucarb	3766-81-2	Thiobencarb	28249-77-6

Table A-10. Pesticides Analyzed in 2011 Using EPA Method 8181B (GC/ECD)

Pesticide	CAS Number	Pesticide	CAS Number
a-BHC	319-84-6	Ethalfluralin	55283-68-6
b-BHC	319-86-8	Etridiazole	2593-15-9
g-BHC	58-89-9	Fenarimol	60168-88-9
d-BHC	319-86-8	Fenvalerate	51630-58-1
Acetochlor	34256-82-1	Flutolanil	66332-96-5
Alachlor	15972-60-8	Folpet	133-07-3
Aldrin	309-00-2	Heptachlor	76-44-8
Benfluralin	1861-40-1	Heptachlor epoxide	1024-57-3
Bifenthrin	82657-04-3	Hexachlorobenzene	118-74-1
Captafol	2939-80-2	Iprodione	36734-19-7
Captan	133-06-2	Methoxychlor	72-43-5
Chlordane	57-74-9	Metolachlor	51218-45-2
Chlorobenzilate	5150-15-6	Mirex	2385-85-5
Chloroneb	2675-77-6	Norflurazon	27314-13-2
Chlorothalonil	1897-45-6	Ovex	80-33-1
Chlorpyrifos	2921-88-2	Oxadiazon	19666-30-9
Cyfluthrin	68359-37-5	Oxyfluorfen	42874-03-3
Cyhalothrin	68085-85-8	PCNB	82-68-8
Cypermethrin	52315-07-8	Pendimethalin	40487-42-1
Dacthal	65862-98-8	Permethrin	52645-53-1
DCBP	90-98-2	p,p'-DDD	72-54-8
Deltamethrin	52918-63-5	p,p'-DDE	72-55-9
Dichlobenil	1194-65-6	p,p'-DDT	50-29-3
Dicloran	99-30-9	Prodiamine	29091-21-2
Dicofol	115-32-2	Pronamide	23950-58-5
Dieldrin	60-57-1	Propachlor	1918-16-7
Dithiopyr	97886-45-8	Propanil	709-98-8
Endosulfan I	959-98-8	Propiconazole	75881-82-2
Endosulfan II	33213-65-9	Terbacil	5902-51-2
Endosulfan sulfate	1031-07-8	Trifloxystrobin	141517-21-7
Endrin	72-20-8	Triflumizole	68694-11-1
Endrin aldehyde	7421-93-4	Trifluralin	1582-09-8
Endrin ketone	53494-70-5	Vinclozalin	50471-44-8
Esfenvalerate	66230-04-4		

Table A-11. Pesticides Analyzed in 2011 Using EPA Method 8141B (GC/FPD)

Pesticide	CAS Number	Pesticide	CAS Number
Aspon	7558-80-7	Fensulfothion	115-90-2
Azinphos-methyl	86-50-0	Fenthion	55-38-9
Carbofenothion	786-19-6	Malathion	121-75-5
Chlorfenvinphos	470-90-6	Merphos	298.515
Chlorpyrifos-methyl	5598-13-0	Methidathion	950-37-8
Coumaphos	56-72-4	Mevinphos	7786-34-7
Demeton	8065-48-3	Monocrotophos	6923-22-4
Diazinon	333-41-5	Parathion	56-38-2
Dichlorofenthion	97-17-6	Parathion methyl	298-00-0
Dichlorvos	62-73-7	Phorate	298-02-2
Dicrotophos	141-66-2	Phosmet	732-11-6
Dimethoate	60-51-5	Phosphamidon	13171-21-6
Disulfoton	298-04-4	Pirimiphos-methyl	29232-93-7
EPN	2104-64-5	Ronnel	299-84-3
Ethion	563-12-2	Sulprofos	35400-43-2
Ethoprop	13194-48-4	Terbufos	13071-79-9
Famphur	52-85-7	Tetrachlorvinphos	22248-79-9
Fenamiphos	22224-92-6	Tokuthion	34643-46-4
Fenitrothion	122-14-5	Trichloronate	327-98-0

Table A-12. Pesticides Analyzed in 2011 Using EPA Method 8270D (GC/MS SIM)

Pesticide	CAS Number	Pesticide	CAS Number
Ametryn	834-12-8	Metalaxyl	57837-19-1
Amitraz	33089-61-1	Metribuzin	21087-64-9
Atrazine	1912-24-9	Myclobutanil	96281-50-4
Bromopropylate	18181-80-1	Napropamide	15299-99-7
Cyanazine	11096-88-1	Pirimicarb	23103-98-2
Diclofop-methyl	51338-27-3	Prometon	1610-18-0
Dimethenamid	87674-68-8	Prometryn	7287-19-6
Ethofumesate	26225-79-6	Propargite	2312-35-8
Fenbuconazole	114369-43-6	Propazine	139-40-2
Fenoxaprop-ethyl	82110-72-3	Pyridaben	96489-71-3
Fipronil	120068-37-3	Sethoxydim	74051-80-2
Fluazifop-p-butyl	69806-50-4	Simazine	122-34-9
Fludioxonil	131341-86-1	Simetryn	1014-70-6
Fluroxypyr-meptyl	81406-37-3	Tebuconazole	107534-96-3
Hexazinone	51235-04-2	Tebuthiuron	34014-18-1
Mefenoxam	70630-17-0	Triadimefon	43121-43-3

Table A-13. Pesticides Analyzed in 2011 Using Monsanto Method (HPLC/FLD)

Pesticide	CAS Number	Pesticide	CAS Number
AMPA	1066-51-9	Glyphosate	1071-83-6

WATER ANALYSES

Table A-14. Metals analyzed in 2011 by EPA Method 200.8

Element	Chemical Abstract Service Registry (CAS) Number	Element	CAS Number
Aluminum	7429-90-5	Copper	7440-50-8
Antimony	7440-22-4	Lead	7439-92-1
Arsenic	7440-38-2	Mercury	7439-97-6
Barium	1304-29-6	Nickel	7440-02-0
Beryllium	7440-41-7	Selenium	7782-49-2
Cadmium	7440-43-9	Thallium	7440-28-0
Chromium	7440-47-3	Zinc	7440-66-6

Table A-15. Aroclors Analyzed in 2011 by EPA Method 608

PCB	CAS Number	PCB	CAS Number
Aroclor-1016	12674-11-2	Aroclor-1248	12672-29-6
Aroclor-1221	11104-28-2	Aroclor-1254	11097-69-1
Aroclor-1232	11141-16-5	Aroclor-1260	11096-82-5
Aroclor-1242	53469-21-9		

Table A-16. Herbicides Analyzed in 2011 by EPA Method 615 in 2011

Herbicide	CAS Number	Herbicide	CAS Number
2,4,-D	94-75-7	Dichlorprop	15165-67-0
2,4-DB	94-82-6	Dinoseb	88-85-7
2,4,5-T	93-76-5	MCPA	94-74-6
2,4,5-TP (Silvex)	93-72-1	MCPP	93-65-2
Dalapon	75-99-0	Picloram	1918-02-1
Dicamba	1918-00-9		

Table A-17. Diesel and Heavy Oils Using Analyzed in 2011 Using NWTPH-Dx Method

Hydrocarbon	CAS Number	Hydrocarbon	CAS Number
Diesel	68476-34-6	Heavy Oil	90640-86-1

Table A-18. Semi-Volatile Organic Compounds Analyzed in 2011 Using EPA Method 625-SIM

S-VOC	CAS Number	S-VOC	CAS Number
2,4-Dimethylphenol	105-67-9	Dimethylphthalate	131-11-3
2-Methylphenol	95-48-7	Di-n-butylphthalate	84-74-2
4-Methylphenol	106-44-5	Di-n-octylphthalate	117-84-0
bis(2-Ethylhexyl)phthalate	117-81-7	Pentachlorophenol	87-86-5
Butylbenzylphthalate	85-68-7	Phenol	108-95-2

Table A-19. PAHs analyzed in 2011 using EPA method 625-SIM

PAH	CAS Number	PAH	CAS Number
1-Methylnaphthalene	91-20-3	Benzo(k)fluoranthene	207-08-9
2-Methylnaphthalene	91-57-6	Chrysene	218-01-9
Acenaphthene	83-32-9	Dibenzo(a,h)anthracene	53-70-3
Acenaphthylene	208-96-8	Fluoranthene	206-44-0
Anthracene	120-12-7	Fluorene	86-73-7
Benzo(a)anthracene	56-55-3	Indeno(1,2,3-cd)pyrene	193-39-5
Benzo(a)pyrene	50-32-8	Naphthalene	91-20-3
Benzo(b)fluoranthene	205-99-2	Phenanthrene	85-01-8
Benzo(g,h,i)perylene	191-24-2	Pyrene	129-00-0

Table A-20. Pesticides analyzed in 2011 using modified EPA method 8321B (HPLC/MS)

Pesticide	CAS Number	Pesticide	CAS Number
3-Hydroxycarbofuran	16655-82-6	Fenuron	101-42-8
Aldicarb	116-06-3	Flumioxazin	103361-09-7
Aldicarb Sulfone	1646-88-4	Imidacloprid	138261-41-3
Aldicarb sulfoxide	1646-87-3	Isoxaben	82558-50-7
Azoxystrobin	131860-33-8	Linuron	330-55-2
Bendiocarb	22781-23-3	Methiocarb	2032-65-7
Bensulide	741-58-2	Methomyl	16752-77-5
Boscalid	188425-85-6	Monuron	150-68-5
Bromacil	314-40-9	Neburon	555-37-3
Carbaryl	63-25-2	Oxamyl	23135-22-0
Carbofuran	1563-66-2	Propoxur	114-26-1
Carfentrazone-ethyl	128639-02-1	Pyraclostrobin	175013-18-0
Clothianidin	210880-92-5	Pyrimethanil	53112-28-0
DCPMU	3567-62-2	Siduron	1982-49-6
Diphenylamine	122-39-4	Sulfentrazone	122836-35-5
Diuron	330-54-1	Thiabendazole	148-79-8
Fenobucarb	3766-81-2	Thiobencarb	28249-77-6

Table A-21. Pesticides Analyzed in 2011 Using Modified EPA Method 8181B (GC/ECD)

Pesticide	CAS Number	Pesticide	CAS Number
a-BHC	319-84-6	Ethalfluralin	55283-68-6
b-BHC	319-86-8	Etridiazole	2593-15-9
d-BHC	319-86-8	Fenarimol	60168-88-9
g-BHC	58-89-9	Fenvalerate	51630-58-1
Acetochlor	34256-82-1	Flutolanil	66332-96-5
Alachlor	15972-60-8	Folpet	133-07-3
Aldrin	309-00-2	Heptachlor	76-44-8
Benfluralin	1861-40-1	Heptachlor epoxide	1024-57-3
Bifenthrin	82657-04-3	Hexachlorobenzene	118-74-1
Captafol	2939-80-2	Iprodione	36734-19-7
Captan	133-06-2	Methoxychlor	72-43-5
Chlordane	57-74-9	Metolachlor	51218-45-2
Chlorobenzilate	5150-15-6	Mirex	2385-85-5
Chloroneb	2675-77-6	Norflurazon	27314-13-2
Chlorothalonil	1897-45-6	Ovex	80-33-1
Chlorpyrifos	2921-88-2	Oxadiazon	19666-30-9
Cyfluthrin	68359-37-5	Oxyfluorfen	42874-03-3
Cyhalothrin	68085-85-8	PCNB	82-68-8
Cypermethrin	52315-07-8	Pendimethalin	40487-42-1
Dacthal	65862-98-8	Permethrin	52645-53-1
DCBP	90-98-2	p,p'-DDD	72-54-8
Deltamethrin	52918-63-5	p,p'-DDE	72-55-9
Dichlobenil	1194-65-6	p,p'-DDT	50-29-3
Dicloran	99-30-9	Prodiamine	29091-21-2
Dicofol	115-32-2	Pronamide	23950-58-5
Dieldrin	60-57-1	Propachlor	1918-16-7
Dithiopyr	97886-45-8	Propanil	709-98-8
Endosulfan I	959-98-8	Propiconazole	75881-82-2
Endosulfan II	33213-65-9	Terbacil	5902-51-2
Endosulfan sulfate	1031-07-8	Trifloxystrobin	141517-21-7
Endrin	72-20-8	Triflumizole	68694-11-1
Endrin aldehyde	7421-93-4	Trifluralin	1582-09-8
Endrin ketone	53494-70-5	Vinclozalin	50471-44-8
Esfenvalerate	66230-04-4		

Table A-22. Pesticides Analyzed in 2011 Using Modified EPA Method 8141B (GC/FPD)

Pesticide	CAS Number	Pesticide	CAS Number
Aspon	7558-80-7	Dichlorofenthion	97-17-6
Dichlorvos	62-73-7	Dicrotophos	141-66-2
Dimethoate	60-51-5	Disulfoton	298-04-4
EPN	2104-64-5	Ethion	563-12-2
Ethoprop	13194-48-4	Famphur	52-85-7
Fenamiphos	22224-92-6	Azinphos-methyl	86-50-0
Fenitrothion	122-14-5	Fensulfothion	115-90-2
Fenthion	55-38-9	Malathion	121-75-5
Merphos	298.515	Methidathion	950-37-8
Mevinphos	7786-34-7	Monocrotophos	6923-22-4
Parathion	56-38-2	Parathion methyl	298-00-0
Carbofenothion	786-19-6	Phorate	298-02-2
Phosmet	732-11-6	Phosphamidon	13171-21-6
Pirimiphos-methyl	29232-93-7	Ronnel	299-84-3
Sulprofos	35400-43-2	Terbufos	13071-79-9
Tetrachlorvinphos	22248-79-9	Tokuthion	34643-46-4
Trichloronate	327-98-0	Chlorfenvinphos	470-90-6
Chlorpyrifos-methyl	5598-13-0	Coumaphos	56-72-4
Demeton	8065-48-3	Diazinon	333-41-5

Table A-23. Pesticides Analyzed in 2011 using Modified EPA Method 8270D (GC/MS SIM)

Pesticide	CAS Number	Pesticide	CAS Number
Ametryn	834-12-8	Metalaxyl	57837-19-1
Amitraz	33089-61-1	Metribuzin	21087-64-9
Atrazine	1912-24-9	Myclobutanil	96281-50-4
Bromopropylate	18181-80-1	Napropamide	15299-99-7
Cyanazine	11096-88-1	Pirimicarb	23103-98-2
Diclofop-methyl	51338-27-3	Prometon	1610-18-0
Dimethenamid	87674-68-8	Prometryn	7287-19-6
Ethofumesate	26225-79-6	Propargite	2312-35-8
Fenbuconazole	114369-43-6	Propazine	139-40-2
Fenoxaprop-ethyl	82110-72-3	Pyridaben	96489-71-3
Fipronil	120068-37-3	Sethoxydim	74051-80-2
Fluazifop-p-butyl	69806-50-4	Simazine	122-34-9
Fludioxonil	131341-86-1	Simetryn	1014-70-6
Fluroxypyr-meptyl	81406-37-3	Tebuconazole	107534-96-3
Hexazinone	51235-04-2	Tebuthiuron	34014-18-1
Mefenoxam	70630-17-0	Triadimefon	43121-43-3

Table A-24. Pesticide Analyzed in 2011 Using EPA Method 547 (HPLC/FLD)

Pesticide	CAS Number	Pesticide	CAS Number
AMPA	1066-51-9	Glyphosate	1071-83-6

APPENDIX B

LABORATORY RESULTS

PORT OF CLARKSTON DMMU

Table B-1. Sediment percent TOC and total solids for the Port of Clarkston DMMU

	LGR138.4E	LGR138.4F	LGR138.4G	LGR138.4G2	LGR138.7E	LGR138.7F	LGR138.7G
TOC	0.07%	0.12%	0.12%	0.11%	0.08%	0.16%	0.08%
Total Solids	77.6%	72.8%	74.4%	73.1%	68.7%	70.5%	74.2%
	LGR138.95K	**LGR138.95K2**	**LGR138.9H**	**LGR138.9X**	**LGR138.9Y1**	**LGR138.9Y2**	**LGR139.1X**
TOC	5.3%	1.5%	0.08%	0.07%	1.2%	1.8%	0.5%
Total Solids	61.8%	63.6%	79.1%	75.5%	60.5%	58.1%	67.9%

Table B-2. Sediment metals data (ppm) for the Port of Clarkston DMMU

	2009 Marine SEF	2012 Draft WAC SMS	LGR138.4G	LGR138.4G2	LGR138.95K2	LGR138.9Y1	LGR138.9Y2
Antimony	150.0	-	0.0772	0.062	0.0802	0.0856	0.132
Aluminum	-	-	6,550	6,980	12,600	15,600	1,960
Arsenic	57.0	14.1	1.85[d]	1.97d	3.52[d]	2.84[d]	5.46[d]
Barium	-	-	55.9	64.7	128	138	165
Beryllium	-	-	0.202	0.237	0.52	0.582	0.725
Cadmium	5.1	2.1	0.394	0.0479	0.17	0.218	0.272
Chromium	260.0	72.1	10.4[d]	10.9[d]	16.2[d]	14.8[d]	17.2[d]
Copper	390.0	400.1	8.15[d]	8.11[d]	17.3[d]	20.7[d]	29.3[d]
Nickel	-	26.0	7.66[d]	7.59[d]	12.8[d]	11.6[d]	14.4[d]
Lead	450.0	360.0	3.448	3.971	8.105	9.76	14.22
Mercury	0.41	0.66	0.0206	0.0137	0.045	0.0491	0.109
Selenium	-	11.0	1.9[d]	1.5[d]	2.64[d]	3.62[d]	3.84[d]
Silver	6.1	0.57	0.0313	0.0368	0.0921	0.107	0.146
Thallium	-	-	0.0657	0.0763	0.159	0.147	0.191
Vanadium	-	-	18.0	21.9	32.1	51.1	49.6
Zinc	410.0	3,200.0	32.4[d]	32.6[d]	49.4[d]	54.5[d]	57.1[d]

d Qualifier = The spiked compound was not detected due to sample extract dilution.

Table B-3. Sediment PAH data (ppb) for the Port of Clarkston DMMU

	2009 Marine SEF	2012 Draft WAC SMS	LGR138.4G	LGR138.4G2	LGR138.95K2	LGR138.9Y1	LGR138.9Y2
1-Methylnaphthalene	-	-	-	-	-	-	-
2-Methylnaphthalene	-	-	-	-	-	-	-
Acenaphthene	500.0	-	-	-	-	-	-
Acenaphthylene	560.0	-	-	-	-	-	-
Anthracene	960.0	-	-	-	-	-	-
Benzo(a)anthracene	1,300.0	-	-	-	8.9	-	-
Benzo(a)pyrene	1,600.0	-	-	-	-	-	-
Benzo(b)fluoranthene	3,200.0	-	-	-	-	-	-
Benzo(g,h,i)perylene	670.0	-	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	-	-	-
Chrysene	1,400.0	-	-	-	-	-	-
Dibenzo(a,h)anthracene	230.0	-	-	-	-	-	-
Fluoranthene	1,700.0	-	-	-	-	-	-
Fluorene	540.0	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	600.0	-	-	-	-	-	-
Naphthalene	2,100.0	-	-	-	-	-	-
Phenanthrene	1,500.0	-	-	-	8.37	-	-
Pyrene	2,600.0	-	-	-	16.2	-	-
Total LPAH	5,200.0	-			8.37		
Total HPAH	12,000.0	-			25.1		
Total PAHs	-	17,000.0			33.47		

Table B-4. Sediment petroleum hydrocarbon data (ppm) for the Port of Clarkston DMMU

	2009 Marine SEF	2012 Draft WAC SMS	LGR138.4G	LGR138.4G2	LGR138.95K2	LGR138.9Y1	LGR138.9Y2
Diesel	-	340.0	-	-	-	-	-
Heavy Oil	-	3,600.0	-	-	86.0	-	-

PORT OF LEWISTON DMMU

Table B-5. Sediment percent TOC and total solids data for the Port of Lewiston DMMU

	CLW1.1A1	CLW1.1B	CLW1.25A	CLW1.2B	CLW1.2C	CLW1.3A
TOC	0.08%	0.06%	0.12%	0.12%	0.29%	0.21%
Total Solids	75.4%	75.8%	77.0%	79.9%	78.7%	73.8%
	CLW1.3B	**CLW1.3C**	**CLW1.4A**	**CLW1.4B**		
TOC	0.10%	0.05%	0.38 %	ND		
Total Solids	79.0%	83.3%	73.4%	88.0%		

Table B-6. Sediment metals data (ppb) for the Port of Lewiston DMMU

	2009 Marine SEF	2012 Draft WAC SMS	CLW1.2C
Antimony	150.0	-	0.0266
Aluminum	-	-	5,860
Arsenic	57.0	14.1	0.797[d]
Barium	-	-	63.4
Beryllium	-	-	0.21
Cadmium	5.1	2.1	0.0494
Chromium	260.0	72.1	6.3 [d]
Copper	390.0	400.1	5.62 [d]
Nickel	-	26.0	4.43 [d]
Lead	450.0	360.0	2.459
Mercury	0.41	0.66	0.0125
Selenium	-	11.0	-
Silver	6.1	0.57	0.0244
Thallium	-	-	0.0527
Vanadium	-	-	21.9
Zinc	410.0	3,200.0	22.7 [d]

d qualifier = The spiked compound was not detected due to sample extract dilution.

Table B-7. Sediment PAH data (ppb) for the Port of Lewiston DMMU

	2009 Marine SEF	2012 Draft WAC SMS	CLW1.2C
1-Methylnaphthalene	-	-	-
2-Methylnaphthalene	-	-	-
Acenaphthene	500.0	-	-
Acenaphthylene	560.0	-	-
Anthracene	960.0	-	-
Benzo(a)anthracene	1,300.0	-	7.73
Benzo(a)pyrene	1,600.0	-	13.4
Benzo(b)fluoranthene	3,200.0	-	13.4
Benzo(g,h,i)perylene	670.0	-	9.35
Benzo(k)fluoranthene	-	-	8.95
Chrysene	1,400.0	-	-
Dibenzo(a,h)anthracene	230.0	-	4.07
Fluoranthene	1,700.0	-	-
Fluorene	540.0	-	-
Indeno(1,2,3-cd)pyrene	600.0	-	11.4
Naphthalene	2,100.0	-	-
Phenanthrene	1,500.0	-	5.29
Pyrene	2,600.0	-	12.2
Total LPAH	5,200.0	-	0.00
Total HPAH	12,000.0	-	85.79
Total PAHs	-	17,000.0	85.79

CLARKSTON BEND DMMU

Table B-8. Sediment percent TOC and total solids data for the Clarkston Bend DMMU

	LGR139.1X
TOC	0.5%
Total Solids	67.9%
% Silt	6.6%

Lower Snake River Draft Programmatic Sediment Management Plan Environmental Impact Statement

Appendix J: 2013/2014 Navigation Maintenance Monitoring Plan

Prepared by USACE, 2012

TABLE OF CONTENTS

LIST OF FIGURES

1 INTRODUCTION

The Walla Walla District of the U.S. Army Corps of Engineers (Corps) proposes to perform navigation channel maintenance dredging at four locations in the lower Snake River and lower Clearwater River in Washington and Idaho. The dredging would occur during the winter in-water work window, which is currently identified as December 15 through March 1,in the first window available following completion of the Lower Snake River Programmatic Sediment Management Plan/Environmental Impact Statement (PSMP/EIS). The purpose of the channel maintenance activities is to provide a 14-foot depth as measured at minimum operating pool (MOP) throughout the designated Federal navigation channel in the project area and to restore access to selected port berthing areas. Dredging would occur in the Federal navigation channel at the confluence of the Snake and Clearwater Rivers, at the downstream approach to the Ice Harbor Dam navigation lock, and at Port of Clarkston and Port of Lewiston berthing facilities in Lower Granite reservoir. Disposal would be in-water on a mid-depth underwater bench immediately upstream of Knoxway Canyon at RM 116 in Lower Granite reservoir. The material would be used to create shallow-water rearing habitat for juvenile salmonids.

The monitoring plan for the maintenance dredging evaluates several issues associated with the proposed dredging and disposal. These issues include water quality, biological impacts, and structural stability of the disposed material. The Corps has consulted with National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) in recent years to assess potential impacts of dredging and disposal on fish use [Endangered Species Act (ESA)-listed salmonids and bull trout in particular] in the lower Snake and Clearwater Rivers, and this plan addresses those issues as well. This plan includes water quality monitoring that has been historically required for maintenance dredging projects in the lower Snake River as well as addressing concerns raised in previous ESA consultations. These concerns include viability of fish habitat and stability of the disposal embankment. Additional monitoring requirements may be identified in the Section 401 Water Quality Certification the Corps is requesting from Washington Department of Ecology, the short term activity exemption the Corps is requesting from Idaho Department of Environmental Quality, and the ESA consultation the Corps is currently performing with NMFS and USFWS. These more specific requirements would be incorporated into any future work plans of contracts associated with the dredging and disposal project.

This monitoring plan describes monitoring activities conducted during three different time periods: pre-dredging, during dredging and disposal, and post-dredging and disposal. Some of the monitoring has already occurred and was used to plan the proposed dredging and disposal activities. Some monitoring would extend up to 10 years following final shaping of the disposal site. The Corps intends to issue one or more reports presenting the results of the monitoring. All the Corps' monitoring activities described in this plan may be conducted either by the Corps or its contractors, based on the availability of funds.

2 PURPOSE

The purpose of the monitoring of the dredging and disposal is to:

- Address concerns related to ESA consultation with NMFS and USFWS and their respective Biological Opinions for the immediate need maintenance dredging action.
- Comply with the terms and conditions of the Clean Water Act, Section 401 Water Quality Certification that the Corps is requesting from Washington Department of Ecology, as well as the short term activity exemption the Corps is requesting from Idaho Department of Environmental Quality.
- Gather information for adaptive management in planning future dredging and disposal activities, and for mainstem habitat-related activities.

3 MONITORING

3.1 Pre-dredging

The Corps identified a need to perform biological monitoring prior to the start of any dredging or disposal activities. Some of this monitoring has already occurred and was used in designing the proposed dredging and disposal activities. Some of the monitoring would not occur until shortly before dredging begins. Descriptions of these monitoring efforts are below.

3.1.1 Redd Surveys

The Corps would perform redd surveys within the total boundary of the proposed dredging template for Ice Harbor navigation lock approach in the fall (November through mid-December) just prior to dredging to determine if any fall Chinook spawning has occurred in the navigation lock approach. Threatened Snake River fall Chinook salmon are known to spawn in the mainstem river using the type of cobble and large gravel substrate routinely found in dam tailwaters when other appropriate conditions are available. Following a thorough literature review and decades of experience surveying redds in the productive Hanford Reach of the Columbia River, Dauble et al. (1994) defined preferred ocean-type (sub-yearling) or fall Chinook salmon spawning criteria as:

- 0-25 feet depth,
- 0-20 degrees slope,
- unconsolidated large gravel, cobble, or boulder substrate,
- 2-6 feet per second water velocities.

Upon further study of refining preferred salmon spawning habitat criteria for use in predictive habitat models used for larger mainstem river reaches, Dauble et al. (2003) included hyporheic upwelling flow as an important correlative criteria required for successful redd production and increasing the probability of researchers locating redd aggregations. Fall Chinook usually spawn in the Snake River in late-November and early December. Redd surveys have occurred in several years since 1993 in the tailwaters of lower Snake River dams proposed for dredging.

In 1993, the first year in which comprehensive surveys were conducted, a total of 18 redds were found, accounting for approximately 7.5% of all redds found in the Snake River basin. Additional surveys were conducted at Lower Granite and Lower Monumental dams in association with in-river dredging in 2002, 2004, and 2005 (Mueller 2003, 2006; Mueller and Duberstein 2005). These surveys were limited to only likely spawning regions (e.g., near the fish return outfall pipes) and resulted in the finding of a single redd downstream of the fish return outfall pipe at Lower Granite Dam in 2004 (Mueller and Duberstein 2005).

Dauble et al. (1994, 1995) found that while suitable spawning habitat criteria does not occur downriver of the navigation locks at Lower Granite and Lower Monumental dams, such criteria does occur downriver of the navigation locks at Little Goose and Ice Harbor dams. Mueller and Coleman (2007, 2008) and Mueller 2009 found potentially suitable spawning substrate within the immediate vicinity of proposed template at Ice Harbor Dam. However, based on the multiple years of surveys, no redds have ever been found within the navigation lock approaches of any of the lower Snake River projects since surveys began in 1993.

Starting in 2006, USACE Walla Walla District conducted a three year study to determine if fall Chinook salmon (*Oncorhynchus tshawytscha*) spawn within the immediate tailrace regions of Lower Granite, Little Goose, Lower Monumental, and Ice Harbor dams as part of developing a Programmatic Sediment Management Plan for the lower Snake River. As part of this comprehensive evaluation, zones were established downstream of all four lower Snake River dams in which habitat criteria met the requirements for fall Chinook salmon spawning (Mueller and Coleman 2007, 2008; Mueller 2009). In 2006, Mueller and Coleman (2007) confirmed one redd in the tailwaters below Lower Granite Dam and two redds in the tailwaters below Little Goose Dam during comprehensive deepwater video surveys. In 2007, six redds were found in the tailrace regions of two of the four dams—four at Lower Granite Dam and two at Ice Harbor Dam (Mueller and Coleman 2008). In 2008, surveys showed a total of 15 redds in the tailrace regions of two of the four dams – eight redds downstream of Lower Granite Dam; seven redds in the tailrace region of Lower Monumental Dam (Mueller 2009).

Since potential spawning habitat exists within the footprint of the proposed dredging area of the Ice Harbor Dam tailrace, the proposed action may have the potential to disturb and/or harm eggs and alevins in redds if found to be present immediately prior to or during the proposed dredging activities. In an effort to avoid disturbing or harming fall Chinook redds, the Corps would conduct underwater surveys of the proposed dredging site at the Ice Harbor navigation lock in November and the first 2 weeks of December prior to commencing dredging. Techniques similar to those used by Battelle from 1993 to 2008 (Dauble et al. 1994-1998; Mueller 2005, 2009; Mueller and Coleman 2007, 2008) would be employed. This technique has used a combination of a boat mounted underwater video camera tracking system to look at the bottom of the river to identify redds. On at least 2 separate sampling periods (one in November when spawning activity is active and one in December when spawning activity is complete or near-complete), a one-pass search pattern would be conducted throughout a consistent transecting grid of the navigation lock approach template using a systematic tracking method employing a Global Positioning System (GPS) to determine both location of the redds on the river bottom and the position of the boat as it navigated through its search pattern. Results of the surveys would be transferred to the Corps within 2 days of the survey dates in order for compilation prior to December 15, at which time the Corps can communicate results to NMFS for appropriate action. If no redds are located, then the Corps would proceed with proposed dredging within the boundaries of the surveyed template. If one or more redds are located within the proposed dredging template and such redds are verified with video, then the Corps would coordinate with NMFS under Section 7 of the ESA consultation to determine what the appropriate avoidance and protection actions would be prior to dredging the affected location.

3.1.2 Rearing Habitat and Site Use Surveys

The Corps has conducted multiple years of biological surveys within the lower Snake River including at the proposed RM 116 disposal site to determine current usage by juvenile salmonids, potential usage as rearing habitat by fall Chinook, and the efficacy of in-water disposal of dredged material for creating juvenile fall Chinook resting and rearing habitat in the lower Snake River reservoirs. These surveys have been conducted by Corps and their contractors as part of follow-up surveys associated with previous dredging actions and for planning purposes associated with potential future dredging and disposal actions. The results of this research have shown that the use of dredged material to create shallow-water habitat has not adversely impacted salmonid species and after stabilization provides suitable salmonid rearing and shallow habitat functions (Artzen et al, 2012; Gottfried et el, 2011, Tiffan and Conner 2012). These newly built shallow water areas were found to be at least as productive for invertebrates as compared to reference sites, provide beneficial shallow water habitat for natural subyearlings during the spring and summer (i.e., rearing fall Chinook), minimized the presence of predators at that site, and in general made the reservoir environment more hospitable for the Chinook salmon using it (Artzen et al, 2012; Gottfried et el, 2011; Tiffan and Conner, 2012).

The proposed action at Knoxway Canyon (RM 116) is to create a shallow water (<6 feet deep) ribbon composed of sand/silt substrate for resting/rearing habitat area for juvenile fall Chinook salmon on the current mid-depth bench located immediately downstream of where dredged materials were deposited at the Knoxway Bench Lower as part of the 2005/06 dredging action. This location is approximately 0.25 to 0.5 mile upriver of the Knoxway Canyon reference site and immediately downstream of Knoxway Bench Upper reference sites (see Artzen et al, 2012; Tiffan and Conner 2012 for reference). Previous monitoring of this bench, prior to placement of dredged material in 2005/06, indicated zero to low salmonid use, moderate predator use, and low macroinvertebrate species composition and abundance (Bennett et al. 1992-1997; Curet 1993). Recent monitoring indicates use of the Knoxway Bench Lower area by natural subyearling Chinook in higher densities, with longer residency times at the as compared to the Knoxway Bench Upper site (Tiffan and Conner, 2012). The Knoxway Bench Upper site (i.e., the upper half of the Knoxway Bench complex) has a steep lateral bed slope that is not preferred by subyearlings (Tiffan et al.

2006) whereas the shoreline of Knoxway Bench Lower site (i.e., location of the 2005/06 dredged materials) has a suitable lateral bed slope. This difference in lateral bed slopes likely explains the density of subyearlings being nearly twice as high in the area of dredged material deposition as compared to the upper half of the site (Tiffan and Conner, 2012). Based on recent habitat modeling efforts in the Lower Granite pool (Tiffan and Hatten, 2012 in-press), construction of additional salmonid rearing habitat in this area and in near proximity to a moderately suitable reference backwater site that has been shown to be used by rearing Snake River fall Chinook salmon (Artzen et al, 2012), should result in increased benefits to Snake River fall Chinook salmon production and survival at the cohort and population levels attributable to both sites.

Due to concerns regarding potential impacts to juvenile Pacific lamprey as part of the proposed dredging action, a minimally obtrusive electroschocking sled with an optical camera was developed to survey for presence/absence of juvenile Pacific lamprey. In order to assess presence/absence of juvenile Pacific lamprey in the lower Snake River that may be impacted by potential dredging actions Artzen et al. (2012) conducted surveys at 24 sample sites within the lower Snake River to determine presence of juvenile Pacific lamprey including at potential dredge locations (Clarkston Upper and Lower, RM 138), past dredged material disposal sites, and reference sites. No lamprey were observed at any of the 24 sample sites during either of the two sample periods in late July and September 2011. It is plausible that juvenile lamprey were present but not observed with this electroshocking sled as it was recently developed for this specific objective and had a limited testing period prior to deployment. However, while juvenile lamprey are often found in silt/sand substrate (Artzen et al 2012), it is unlikely that juveniles are present in moderate or high numbers in the proposed templates. Juvenile lamprey typically have a patchy distribution related to other environmental variables such as water depth and velocity, light level, organic content, chlorophyll concentration, proximity to spawning area and riparian canopy (Moser et al. 2007).

Biological and physical parameters measured for pre-dredging monitoring associated with rearing habitat and habitat site use have mimicked those measured under Bennett (2003) and Bennett and Seybold (2005). This is so consistency can be maintained for correlation analyses used to estimate effectiveness of the action for benefit to salmonid production and reservoir survival. A wide suite of parameters were measured at the Knoxway Bench (RM 116) disposal site (newly constructed habitat), the Knoxway Canyon reference site (backwater transect site of previous monitoring efforts), and as well as at several other sites in the Lower Granite Reservoir (Gottfried et el, 2011; Tiffan and Connor, 2012) and within the four lower Snake River reservoirs (Artzen et al. 2012) These were sampled at a frequency of up to biweekly during March through November and have generally included:

- Surface sediment/substrate composition and grain size of the habitat, including percent organic or organic content.
- Presence and abundance of macrophyte plants.
- Predator species composition and abundance [catch-per-unit-effort defined as 5 minutes of electrofishing and one seine haul (CPUE)].
- Juvenile salmonid abundance and habitat usage (CPUE).

- Macroinvertebrate species composition, species richness/diversity, periodicity or seasonality, and abundance on both soft and hard substrates, including crayfish.
- Water temperature.
- Bathymetry used to verify designed slope, depth, and acreage.
- Dissolved oxygen.
- Water velocity.
- Secchi depth and surface water elevation.
- Chlorophyll *a*.
- Photo record of shoreline substrate composition, landform, and riparian species composition.

3.2 During Dredging and Disposal Activities

The Corps proposes to perform monitoring during the dredging and disposal activities. This monitoring would be to ensure the Corps is meeting environmental compliance requirements.

3.2.1 Water Quality Monitoring

Water quality monitoring would be conducted during dredging and disposal activities to accomplish two goals:

- Ensure the Corps is meeting applicable water quality standards while performing these activities; and
- Address concerns raised during the ESA consultation process.

The Corps would monitor depth, turbidity, pH, temperature, dissolved oxygen, and conductivity. Water quality monitoring would be performed before, during, and after all in-river work at each active dredging site and at the disposal site.

The water quality monitoring equipment used would meet industry standard sensitivity and accuracy levels available at the time the dredging and disposal takes place. The equipment would have the capability to transmit the data via satellite or radio relay rather than having to be downloaded at each station in the field.

All of the equipment would be calibrated prior to use according to the manufacturer's specifications using recognized industry standards. Cleaning and recalibration would occur daily, and whenever there is any indication that the equipment is not performing properly.

Turbidity data measured by the sondes (i.e., multi-parameter probes) would be verified periodically in the field. This task would consist of collecting water samples when the sondes are calibrated daily, and when questionable values appear in the data set. Sample turbidity would be measured using a portable, calibrated turbidimeter.

Monitoring locations for all parameters will follow the specifications in the Washington Administrative Code (WAC) 173-201A, Idaho Administrative code (IDAPA) 58.01.02, the requirements in the 401 certification the Corps is requesting from the Washington Department of Ecology, and the requirements in the current ESA consultations with NMFS and USFWS. Monitoring would be performed at several points to evaluate water quality, but will generally include:

- Active dredging site (Figure 1)
    - A monitoring zone approximately 1,000-ft long and 600-ft wide would be created around the dredge area.
    - A background station would be placed 300-ft (± 30 ft) upstream of the monitoring zone.
    - Two compliance stations would be located 300-ft (± 30 ft) downstream of the monitoring zone and no less than 100-ft apart.
    - A remote monitoring station would be located 600-ft (± 30 ft) downstream of the monitoring zone.
    - When all dredging is completed inside the zone a new monitoring zone would be defined and the monitoring network repositioned.

- In-river disposal site (Figure 2)
    - A monitoring zone approximately 1,000-ft long and 400-ft wide (measured from the shoreline) would be created around the disposal area.
    - A background station would be located 300-ft (± 30 ft) upstream of the monitoring zone.
    - Two compliance stations would be located 300-ft (± 30 ft) downstream of the monitoring zone and no less than 100-ft apart. The stations would be located in the main direction of the river flow and, to the extent possible, in the direct path of the plume.
    - A lateral monitoring station would be located downstream at a distance of 300 ft outside the disposal area to evaluate whether disposed material moved down-slope towards the thalweg before it was entrained in the river current.
    - When disposal is completed inside the zone, a new monitoring zone would be defined and the monitoring network repositioned.

Measurements would be taken at various depths in the water column. Each floating platform would include two multi-parameter probes. One probe would be located 3 feet below the surface and the second one would be situated approximately 3 feet above the sediment.

The timing of sampling will be as follows:

Floating Stations

- Pre-activity levels would be measured for 1-hour prior to work each new day at a given dredging location and at the disposal site if the work day is 10 hours or less. If work proceeds for 20 hours, or more, during a given day then the work would be considered continuous and pre-activity monitoring would only be required prior to the first day of operation. Instrument readings for each parameter would be taken every 5 minutes and reported near-real time.
- During all dredging and in-river disposal activities, near real-time water quality monitoring would be performed. Equipment would be deployed to allow the results to be monitored by the Corps and regulatory/ cooperating agencies. Readings would be taken every 5 minutes.
- Post-activity levels would be measured for 1 hour following completion of the work at each dredging site and the disposal site. Readings would be taken every 5 minutes and also reported near real time.

Figure 1. Conceptual Plan of Monitoring Station Locations for Dredging Activities Relative to the Dredging Monitoring Zone

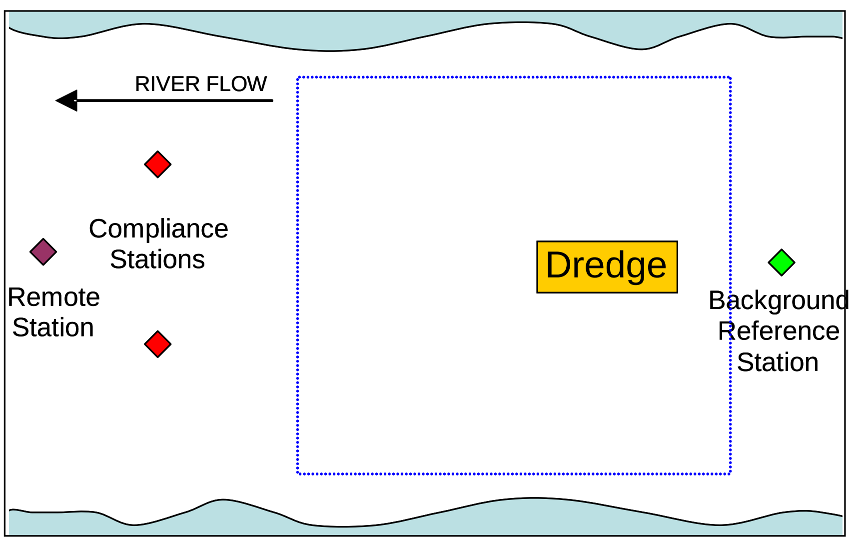
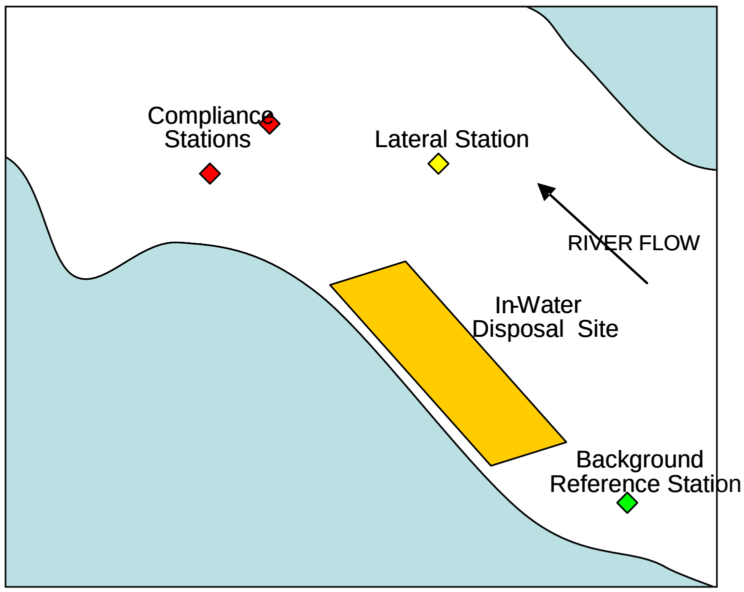


Figure 2. Conceptual Plan for Monitoring Station Locations at Disposal Site



3.2.2 Biological Monitoring

Fish Monitoring

During dredging and disposal activities, the Corps would monitor for sick, injured, or dead fish. The Corps would continuously visually monitor the waters surrounding the dredging and disposal activities as well as observing the content of each clamshell bucket as it discharges in the barges. If a sick, injured, or dead specimen is encountered, it would be placed in a container of cold river water until it could be determined if it was a species listed under the ESA. If it is a listed species, the Corps would then contact the Vancouver Field Office of NOAA Fisheries Law Enforcement as soon as possible for further instructions. If a healthy fish has been entrained by the dredging operations, the Corps would make every reasonable attempt to return the specimen safely back to the river.

3.3 Post-dredging and Disposal

Monitoring performed at the disposal area following completion of disposal activities would consist of hydrographic surveys and biological surveys. The hydrographic surveys would be performed each year for at least 2-3 years to determine if the embankment has sloughed, settled, or moved, and to verify that the desired physical structure determining rearing habitat suitability have been achieved and maintained. The Corps would use the information from these efforts to assess the stability of the embankment in the short-term and long-term to determine if changes need to be made in grain size composition of construction methods for any future in-water disposal of dredged material. Biological surveys would be performed twice over 10 years, if funding is available, to assess the use of the disposal area by target fish species and to document changes in several parameters such as use by juvenile salmonids, sediment grain size, food organisms, and water temperature.

3.3.1 Hydrographic Surveys

The Corps would perform a series of hydrographic surveys of the disposal site. The Corps would perform hydrographic surveys for both the pre and post condition surveys of the disposal area. The Corps would provide survey control to be utilized, a horizontal alignment with stationing, and a drawing representing the required area to be surveyed. The cross sections would be required to be surveyed at specific 25-foot interval spacing for both the pre and post condition surveys performed. The Corps would perform follow up surveys after the first spring runoff (July-September time frame) following disposal utilizing the same control, alignment, and interval requirements. The Corps proposes to replicate the surveys one year later if funding is available.

The results obtained would provide the following data:

1. Dredged material disposal site bathymetry before material placement.
2. Bathymetry of the disposal site after embankment construction (accepted configuration).
3. Embankment bathymetry after first runoff season is complete. Comparing (2) and (3) would identify any erosion and/or settlement that have occurred.
4. Bathymetry of the embankment after second runoff season is complete (if funding is available). Comparing (2) and (4) would identify the overall settlement of the embankment, and any additional erosion that may have occurred. Comparing
   (2), (3) and (4) would also provide curves that could be used for predicting settlement rate and erosion rate for future in-water disposal sites.

This information would provide a good picture of the embankment performance regarding its shape and final geometry.

3.3.2 Biological Monitoring

To evaluate use of the newly created habitat area by juvenile salmonids and food organisms, the Corps would repeat all monitoring tasks under protocols and study designs of tasks outlined above in Section 3.1.2 Fish Habitat and Habitat Site Use Surveys for at least post-construction years 2 and 10, subject to the availability of funding. However, the Corps has modified the sampling timing so the sites would be sampled at a frequency of biweekly during April through July and December and January, and at least monthly during August through November and February through March during biological study years. The Corps would compile draft reports detailing multi-year comparison of research results and would make these available to regulatory agencies and all interested parties for their review and comment prior to the production of a final biological monitoring report.

4 MONITORING CRITERIA AND SUBSEQUENT ACTIONS

4.1 Biological

4.1.1 Redd Surveys

The Corps would discuss the results of the pre-dredging research with NMFS personnel prior to initiating dredging. If a redd is found in the proposed dredging footprint, the Corps would coordinate with NMFS under Section 7 of the ESA consultation to determine what the appropriate avoidance and protection actions would be prior to dredging the affected location. This potentially would include modifying the dredging footprint to avoid the redd and/or postponing dredging in that footprint to a later date after emergence of young fish from the redd in the spring.

4.1.2 Fish Habitat

The Corps, in conjunction with USGS, has conducted a comprehensive modeling effort of juvenile rearing habitat in the Lower Granite Reservoir, where creation of new shallow water habitat appears to be most beneficial (Tiffan and Hatten 2012, in-press). As part of this modeling effort, USGS has estimated the amount of current rearing habitat available in Lower Granite Reservoir at five different flows using a statistical rearing model and a spatially explicit analysis that incorporated river bathymetry and outputs (i.e., depth and velocity) from a hydrodynamic model. Results indicate that Lower Granite Reservoir contains about 255 ha of rearing habitat at a flow of 143 kcfs, which equates to about 7% of the reservoir area when a 20-ft shallow water depth criterion is used. Most available rearing habitat is located in the upper half (i.e., upstream of Centennial Island) of the reservoir and little exists in the lower half due to steep lateral bed slopes and unsuitable substrate along the shorelines. The largest habitat areas were associated with known shallow-water locations such as at Silcott Island (~85 ha) and the area near Steptoe Canyon (~32 ha). Reducing the criterion to define shallow water from <20 ft (the COE's current definition) to <6 ft (based on recent habitat use data) resulted in a significant reduction in available habitat but spatial trends remained consistent. The number of habitat patches did not vary much with flow when the 20-ft depth criterion for shallow-water habitat was used; however, the number of habitat patches was reduced by about 20% when the 6-ft depth criterion was used. Mean habitat patch area was also higher when the 20-ft depth criterion was used, and showed declines with increasing flow, but the distance between rearing patches was greater for the 6-ft compared to the 20-ft depth criterion. Because of the shoreline orientation of subyearling fall Chinook salmon and their transient rearing strategy, creating new habitat in the lower portion of Lower Granite Reservoir in ribbons along the shoreline appears as though it may provide the greatest potential benefit from creation of additional shallow water habitat.

As a result of this modeling effort, recent biological monitoring and evaluation of previous and potential future disposal areas, and other engineering considerations, the proposed disposal area at RM 116 was selected for disposal of dredged material as part of the proposed action. In addition, as a result of recent habitat sampling efforts showing rearing/resting juvenile fall Chinook appear to utilize shallow water habitat <2 meters in depth in higher frequency (Tiffan and Conner 2012) and a general paucity of available shallow water habitat in the lower portion of the Lower Granite Pool (Tiffan and Hatten 2012, in-press) as described above, the Corps will attempt to create shallow water habitat that is primarily less then 6 feet in depth instead of six meters in depth as traditionally done in the past.

Habitat surveys conducted after final shaping of the proposed disposal site would be used to evaluate future use of in-water disposal to create resting/rearing habitat for juvenile salmonids with particular emphasis on evaluating whether the creation of shallow water habitat in a <6 and <20 foot deep ribbon along the shoreline results in increased habitat utilization as expected. These surveys would be used to document several parameters such as trends in usage by juvenile salmonids, changes in food organism composition, and changes in substrate over time as described in previous sections. If the surveys indicated a need to take corrective action at the disposal area, such as possible modifying the contours to reduce predation on juvenile salmonids, the Corps would consider taking this action pending availability of funds.

In addition, the Corps would use numbers of ESA-listed salmonid species or stocks present during critical seasons and life stages compared to presence and extent of critical habitat parameters at that proposed site versus ESA-listed species presence and abundance compared to critical habitat parameters and juxtaposition at alternative reference sites to determine whether or not the proposed criteria for selecting disposal sites and disposal methods would still be acceptable for potential future actions. If the surveys indicated a minimal number of ESA-listed juvenile salmonids were currently using potential future disposal sites, but the habitat suitability index of the site could be substantially increased effectively, the Corps would use the proposed site(s) for disposal with the intent to design to an optimal habitat suitability. The Corps will continue to coordinate with NMFS to determine the continued suitability of the currently proposed site and other potential disposal areas are still acceptable as continued and/or future disposal site(s).

4.2 Water Quality

4.2.1 Turbidity

Turbidity created by in-river activities and measured in nephelometric turbidity units (NTU) would be maintained below the following standards at the locations described in 3.2.1.

- **Washington**
  - 5 NTUs above background when background levels are 50 NTUs or less.
  - Maximum 10 percent increase when the background is more than 50 NTUs.

- **Idaho**
  - Shall not exceed the background by more than 50 NTU instantaneously below the compliance boundary or by more than 25 NTU for more than 10 consecutive days.

Measured turbidity data would be evaluated for trends using one-hour intervals. Specific details regarding trend analysis at each station, as well as between stations, would be developed jointly prior to dredging activities by the Corps and regulatory/cooperating agencies. However, a hypothetical approach is to first flag potential outliers that could be due to signal noise, debris in the sensors, or other factors not related to dredging using commercially available software or spreadsheet calculations. If the 1-hour trend for a given instrument exceeds the standard, the Corps would note the incident in a daily quality control record. If the subsequent 1-hour trend continues to show elevated values above the background for the same instrument, the Corps would verify that the probe is functioning properly. If the condition persists for the third hour, the Corps would then alter the dredging operation (e.g., reducing the rate of dredging) and continue monitoring turbidity at the downstream location. If the NTU levels remain above the acceptable standard the Corps would halt operation and wait for the NTU levels to drop before resuming dredging.

4.2.2 Dissolved Oxygen

Evaluation of temporal trends in the 5-min dissolved oxygen data by the Corps would follow the protocol yet to be determined for turbidity. The Washington water quality standard states that oxygen concentrations must be greater than or equal to 8.0 mg/L, while the Idaho standard is 6.0 mg/L.

If any dissolved oxygen reading is less than 5 mg/L, the Corps would verify instrument calibration and immediately take a second measurement. If the second reading is still less than 5 mg/L, the Corps would stop dredging and continue monitoring. The Corps would then contact the appropriate regulatory agencies to determine a course of action.

4.2.3 pH

Measured pH data would be compared to the state standard by the Corps using the method described for turbidity and dissolved oxygen. The Washington water quality standard designates an acceptable pH range of 6.5 to 8.5 units. The Idaho standard ranges from 6.5 to 9.0 pH units.

If the 1-hour trend in the pH readings for a given instrument exhibits a consistent drift that exceeds the upper and lower boundaries of the standard, the incident would be noted in a daily quality control record. If the subsequent 1-hour trend continues to show consistently increasing or decreasing values relative to the background for the same instrument, the Corps would verify that the probe is functioning properly. If the condition persists for the third hour, the Corps would alter the dredging operation (e.g., reducing the rate of dredging) and continue monitoring pH at the downstream location. If the pH levels remain outside the acceptable range the Corps would halt operation and wait for the values to fall within the acceptable range before resuming dredging.

4.2.4 Temperature

The water quality standards for temperature (20 ^{o}C) would likely not be exceeded during the winter dredge window. The user cannot calibrate sonde temperature, but since the measured dissolved oxygen, pH, and conductivity data are all temperature dependent it is important to verify sonde temperature values using a National Institute of Standards and Technology traceable thermometer

4.3 Hydrographic Surveys

The results of the hydrographic surveys of the disposal site would be used to assess slope stability and long-term structural stability of the disposal area. Changes in elevations would indicate movement of material. The Corps would compare pre-dredging sediment sampling records to the locations of material movement to evaluate the composition of the dredged material (i.e., percent sand vs. percent silt) disposed at that location. Based on the results of the comparison, the Corps may modify its disposal plans for future dredging. Modifications could include altering the percent of silt in in-water disposal areas, or constructing a berm of sand or cobble at the toe of the disposal area slope.

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Appendix K: Snake River Channel Maintenance 2013/2014, Lower Snake River, PM-EC-2007-0001, Biological Assessment

Prepared by USACE, 2012

SNAKE RIVER CHANNEL MAINTENANCE 2013/2014

LOWER SNAKE RIVER

PM-EC-2007-0001

Biological Assessment

U.S. Army Corps of Engineers
Walla Walla District
Environmental Compliance Section

12 December 2012

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Index of Figures

Index of Tables

Glossary

BMP	Best Management Practice
CFR	Code of Federal Regulations
CH	Critical Habitat
cfs	Cubic feet per second
Corps	U.S. Army Corps of Engineers
cy	Cubic Yards
DPS	Distinct Population Segment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ESA	Endangered Species Act of 1973, as amended
ESU	Evolutionarily Significant Unit
FCRPS	Federal Columbia River Power System
FPC	Fish Passage Center
HUC	Hydrologic Unit Code
ICBTRT	Interior Columbia Basin Technical Recovery Team
IDFG	Idaho Department of Fish and Game
MCR	Middle Columbia River
MPG	Major Population Group
MOP	Minimum Operating Pool
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NEPA	National Environmental Policy Act of 1969, as amended
NMFS	National Marine Fisheries Service
NTU	Nephelometric Turbidity Units
PCE	Primary Constituent Element
PFMC	Pacific Fishery Management Council
PIT	Passive Integrated Transponder
Rkm	River Kilometer
ROD	Record of Decision
SR	Snake River
SRB	Snake River Basin (steelhead)
SRF	Snake River Fall (Chinook)
SRSS	Snake River Spring/Summer (Chinook)
UCR	Upper Columbia River
USFWS	U.S. Fish and Wildlife Service
WADOE	Washington Department of Ecology

I. Endangered Species Act of 1973: Biological Assessment

1. Introduction

The U.S. Army Corps of Engineers (Corps) proposes to perform maintenance dredging in 2013/2014 to meet the immediate need of providing a 14-foot navigation channel depth as measured at minimum operating pool (MOP) at four locations in the lower Snake River and lower Clearwater River in Washington and Idaho (Figure 1). The 14-foot minimum depth is the depth required to safely pass large boats and barges. The Corps is authorized by the Flood Control Act of 1952 (Public Law 87-874) to maintain a 14 foot deep channel.

One proposed dredging site is the downstream navigation lock approach for Ice Harbor Dam [Snake River river mile (RM) 9.5], while the other three sites are located at the confluence of the Snake and Clearwater rivers in Lower Granite reservoir. The three sites in Lower Granite are the Federal channel (Snake RM 138 to Clearwater RM 2) and the berthing areas for the Port of Lewiston (Clearwater RM 1-1.5) and Port of Clarkston (Snake RM 137.9 and 139). The Corps identified a suitable, mid-depth location in the Lower Granite reservoir, Snake River Mile (RM) 116 just upstream of Knoxway Canyon, as the in-water discharge site of the dredged materials. The Corps proposes to use the dredged material in a beneficial manner to create additional shallow water habitat for juvenile salmonids.

Channel maintenance by dredging has occurred periodically since 1961 (see Table 1) and was an anticipated action necessary to keep the channel operating for its designated navigational uses. Navigation channel maintenance has not occurred since 2005/2006. Shoaling in the channel and port berthing areas has become critical in these locations. Sediment (mostly sand) has been depositing in these areas in the Snake/Clearwater confluence primarily during spring runoff periods. Bathometric survey results from August 2011 show that the area of the Federal navigation channel shallower than 14 feet (as measured at minimum operating pool (MOP) in the Snake/Clearwater river confluence area) has risen from approximately 38 acres in 2010 to about 50 acres in 2011, an increase of 31 percent. It is likely that additional sediment has been deposited in 2012 and will be in 2013, further increasing the area which does not meet the authorized channel depth. Water depths in the Federal navigation channel at the confluence are now as shallow as 7 feet while the berthing areas at the Port of Clarkston and Port of Lewiston are now as shallow as 7 feet and 9 feet, respectively, based on a MOP water surface elevation. Navigation channel depths less than 14 feet substantially impact access to port facilities.

Shoaling in the Ice Harbor navigation lock approach is interfering with the ability of barge traffic to safely maneuver when entering or exiting the navigation lock. Spill flows at the dam have scoured rock from the base of the four rock-filled coffer cells bordering the lock approach and have pushed material from the edge of the lock approach into the channel, narrowing the room available for barges to maneuver between the coffer cells and the north shore (see figure 7 on page 9). In addition, at least one of the coffer cells has been losing rockfill through the exposed base and this may be contributing to the material encroaching in the lock approach. This material has created a shoal that encroaches across the south half of the lock approach for about 480 feet, reducing the depth to about 9 feet. Temporary repairs to the coffer cell were attempted in 2012.

This biological assessment (BA) documents potential effects to Endangered Species Act (ESA) listed species that may occur as a result of the Corps proposed navigation channel maintenance activities on the lower Snake and Clearwater rivers. In addition, the action area is designated as Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996, 16 United States Code (U.S.C.) 1855, for Chinook salmon (*Oncorhynchus tshawytscha*) and coho salmon (*O. kisutch*). This BA will be used to facilitate ESA Section 7 formal consultation with the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS).

2. Background / History

2.1. Project History

2.1.1. Documentation of Relevant Correspondence

The Corps sent NMFS and USFWS a BA in 2003 analyzing the effects of a proposed 2004/2005 dredging action. NMFS issued a Biological Opinion (BiOp) on March 15, 2004 (NMFS Tracking No. 2003/01293) that concluded implementation of the proposed action was not likely to jeopardize the continued existence of any of the ESA listed species or result in the destruction or modification of designated critical habitat. The dredging was not conducted in 2004/2005. Later the Corps changed the project description slightly. On June 1, 2005, NMFS sent a letter stating they agree with the Corps that the changes to the proposed action would not affect ESA-listed species beyond the effects anticipated by, and considered in, the March 2004 BiOp, and agreed the Corps had satisfied its responsibilities for ESA and MSA consultation.

Similarly, the USFWS issued a BiOp for the 2004/2005 proposed dredging action on October 18, 2004 concluding the action was not likely to jeopardize the continued existence of bull trout or bald eagles. As with the NMFS consultation, the USFWS sent a letter dated July 3, 2005 when the Corps changed the year the action would occur and the proposed action slightly, stating the modifications to the proposed action did not change the analysis of effects in the 2004 BiOp and that it still applied to the modified proposed action.

The Corps signed a Record of Decision (ROD), completing the Environmental Impact Statement (EIS) under the National Environmental Policy Act (NEPA) in July 2005 on the 2005-06 dredging effort. The ROD selected the Maintenance Dredging with Beneficial Use of Dredged Material alternative.

March 23, 2012 to May 29, 2012 – Email correspondence between the Corps (Ben Tice) and the Services (Dale Bambrick, NMFS; Michelle Eames, USFWS) concluding a programmatic consultation is not feasible unless specific actions can be identified for construction. Consultation on specific actions is appropriate.

August 9, 2012 - A pre-consultation conference call and net meeting was held between NMFS, USFWS and the Corps. The Corps (Sandy Shelin) used a PowerPoint to present background information and the Corps' preliminary proposed plan. A programmatic vs. a case by case, site specific consultation was discussed. It was determined it would be very difficult to do a programmatic consultation in time for implementation of a 2013 action. A more detailed summary of the meeting can be provided by Ben Tice (509-527-7267).

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Corps of Engineers, Walla Walla District 2012b. Lower Snake and Clearwater Rivers - Draft Sediment Evaluation Report for Proposed 2013/2014 Channel Maintenance. Walla Walla, WA. September 2012. (Available on request)

2.1.3. Federal Action History

The Federal navigation channel in the Snake River refers to that portion of the Snake River inland navigation waterway maintained by the Corps. It begins at the Columbia/Snake River confluence and includes the Ice Harbor, Lower Monumental, Little Goose, and Lower Granite Locks and Dams and associated reservoirs (Lake Wallula, Lake Sacajawea, Lake West, Lake Bryan, and Lower Granite Lake, respectively) on the lower Snake River and ends on the Clearwater River about a mile upstream of the Snake/Clearwater River confluence. The Corps maintains a 14-foot-deep, 250-foot-wide navigation channel through these reservoirs. The Corps is authorized by the Flood Control Act of 1952 (Public Law 87-874) to maintain the channel to these dimensions. There are several main areas of sedimentation problems in the Federal navigation channel: the Snake-Clearwater River confluence in the vicinity of Lewiston, Idaho, and Clarkston, Washington, and the navigation lock approaches below each of the dams.

The confluence of the lower Snake River and Clearwater Rivers occurs at the approximate point of the river-to-reservoir interface for the Lower Granite reservoir. The confluence is bounded by Lewiston, Idaho, and Clarkston, Washington. The Snake River interface with the Lower Granite reservoir begins approximately two miles upriver from this confluence. Gravels and large sands are generally deposited above the confluence. At the confluence, the river's suspended sediment load is primarily smaller sands, silts, clays, and other fine particles. Sampling has shown that sand is the dominant material. The Clearwater River interface with the Lower Granite reservoir begins almost at the confluence. The combination of river-to-reservoir interface and the confluence of the two rivers cause both rivers to lose energy. The result is an ongoing deposition of sediment within the confluence area. The Lower Granite reservoir is estimated to trap approximately 85 percent of the sediment entering the reservoir, with approximately 50 percent of the total sediment load entering the reservoir settling out in the area of the confluence between Lewiston and RM 120. The Federal navigation channel from just downstream of the Port of Clarkston upriver to the Port of Lewiston and the non-Federal navigation areas of the two ports periodically lack adequate water depth for navigation.

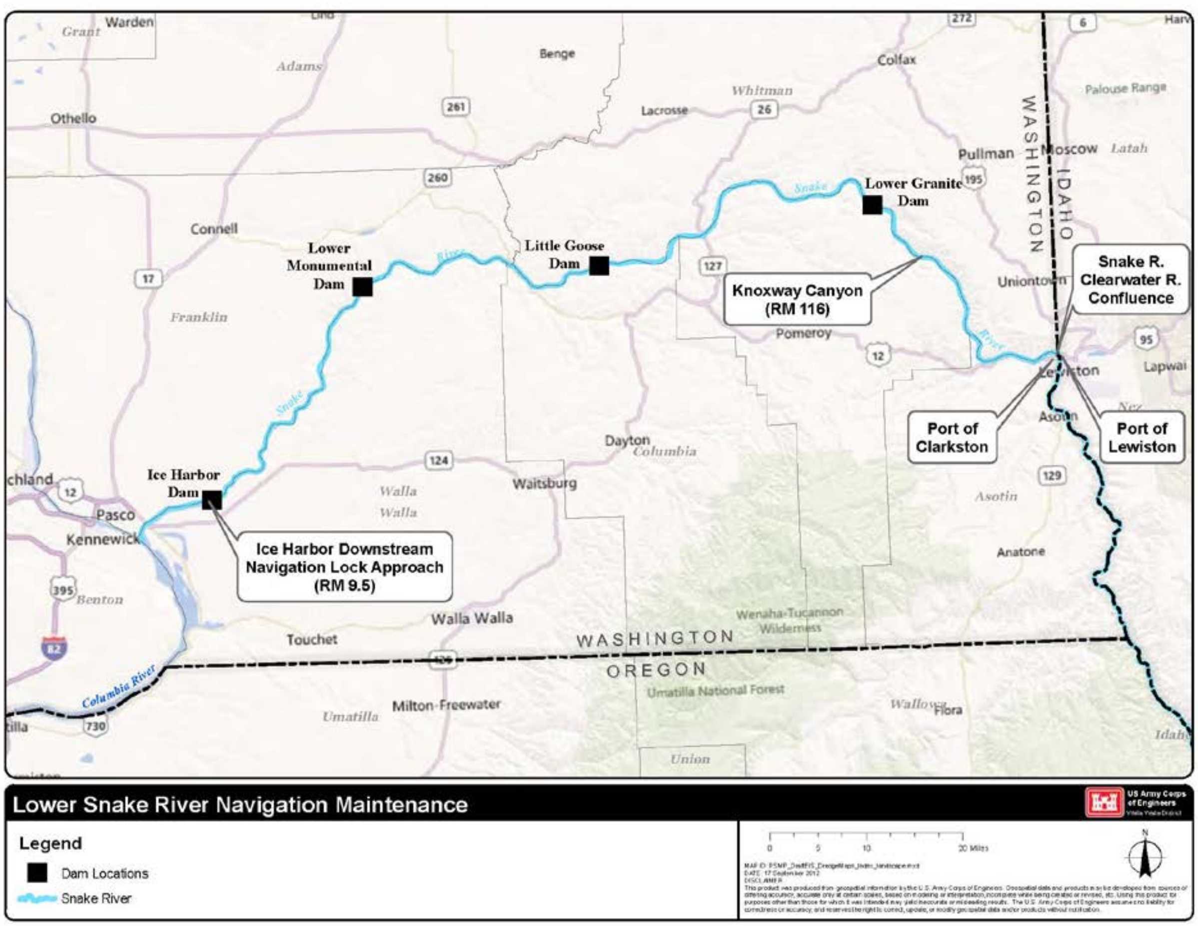

Figure 1 Project action area map of the lower Snake River hydrosystem and navigation system

There are ongoing problems with sedimentation that occur at the downriver approaches to the navigation locks. Each of the four lower Snake River projects is authorized to provide navigation facilities, including locks with dimensions 86 feet wide and over 665 feet long to allow passage of a tug with the four-barge tow commonly used in river navigation. Construction of these dams created a series of slackwater reservoirs on the Snake River, adding an additional 140 miles to the Columbia/Snake River shallow-draft (14-foot) inland navigation system. Areas in the Federal navigation channel within approximately 0.25 to 0.5 miles below the navigation locks at Ice Harbor, Little Goose, Lower Monumental, and Lower Granite Dams periodically experience an excess of sediment materials. The materials are cobble and gravel, similar to the riverbed materials in adjacent areas outside the navigation channel and just below the dams. The cobble and gravel are too large to be readily suspended and are not likely to be bedload, as bedload is unlikely to pass through the locks or over the dam. The source of these unwanted sediment deposits are believed to be a redistribution of local riverbed material caused by flow passing through the spillways during high flows and the sloughing from steep slopes of the channel through hydraulic actions of barge guidance into the lock and initiation of passage through the locks. Discharge through the spillways has been increased in the past decade to aid downriver juvenile salmonids passage through each dam.

Non-Federal navigation areas include commercial ports and berths operated by local port districts or private companies. Most of these non-Federal navigation areas consist of side channels leading from the main Federal navigation channel to the port or berth as well as those areas at the port or berth used for loading, unloading, mooring, or turning around. These facilities are typically designed to accommodate river tugs with up to four barges in tow. Some facilities also accommodate river tour boats carrying recreational passengers.

A history of Walla Walla District dredging in the lower Snake and Clearwater Rivers is shown in Table 1.

Since 2001, NMFS and other agencies have determined the potential negative impacts on listed species that could occur in the project area during the established in-water work window may be more significant than the similar actions that occurred prior to 1999. As a result, the effects from dredging actions on ESA-listed salmonid Evolutionarily Significant Units (ESUs) and Distinct Population Segments (DPSs) have required ESA Section 7 formal consultation. These species primarily include juvenile Snake River Fall (SRF) Chinook salmon and Snake River Basin (SRB) steelhead. In previous consultations the Services have determined the action would not jeopardize the continued existence of the (listed) species or destroy or cause adverse modification to designated critical habitats.

Table 1 History of Channel Maintenance in the Lower Snake and Clearwater Rivers

Dredging Location	Year	Purpose	Amount Dredged [cubic yards (cy)]	Disposal
Excavation of Navigation Channel, Ice Harbor, Part I and II, Channel Construction	1961	Navigation	3,309,500	Upland and in-Water
Navigation Channel, Ice Harbor Part III, Channel Construction	1962	Navigation	120,000	Upland and in-Water
Downstream Navigation Channel, Ice Harbor Lock and Dam	1972	Navigation	80,000	Upland and in-Water
Downstream Approach Navigation Channel, Lower Monumental Lock and Dam	1972	Navigation	25,000	Upland
Navigation Channel Downstream of Ice Harbor Lock and Dam	1973	Navigation	185,000	Upland and in-Water
Downstream Approach Channel Construction, Lower Monumental Lock	1973	Navigation	10,000	Upland
Downstream Approach Channel Construction, Ice Harbor Lock	1978	Navigation	110,000	Upland and in-water
Downstream Approach Channel Construction, Ice Harbor Lock	1978 1981/82	Navigation	816,814	Upland and in-water
Various Boat Basins, Swallows Swim Beach, Lower Granite Reservoir (Corps)	1975-1998	Recreation	20,000	Upland sites
Port of Lewiston – Lower Granite Reservoir (Corps)	1982	Navigation/Maintain Flow Conveyance Capacity	256,175	Upland sites
Port of Clarkston – Lower Granite Reservoir (Corps)	1982	Navigation	5,000	Upland sites
Downstream Approach Channel Construction, Ice Harbor Lock	1985	Navigation	98,826	In-water
Confluence of Clearwater and Snake Rivers (Corps)	1985	Maintain Flow Conveyance Capacity	771,002	Upland site
Port of Lewiston – Lower Granite Reservoir (Corps)	1986	Navigation/Maintain Flow Conveyance Capacity	378,000	Upland sites
Confluence of Clearwater and Snake Rivers (Corps)	1988	Maintain Flow Conveyance Capacity	915,970	In-water
Confluence of Clearwater and Snake Rivers (Corps)	1989	Maintain Flow Conveyance Capacity	993,445	In-water
Schultz Bar – Little Goose (Corps)	1991	Navigation	27,335	Upland site
Confluence of Clearwater and Snake Rivers (Corps)	1992	Maintain Flow Conveyance Capacity	520,695	In-water
Barge Approach Lane, Juvenile Fish Facilities, Lower Monumental	1992	Navigation	10,800	Upland site
Ports of Lewiston (Lower Granite Reservoir), Almota and Walla Walla	1991/92	Navigation	90,741	Upland and in-water
Schultz Bar – Little Goose (Corps)	1995	Navigation	14,100	In-water
Confluence of Clearwater and Snake Rivers (Corps)	1996/97	Navigation	68,701	In-water
Confluence of Clearwater and Snake Rivers (Corps)	1997/98	Navigation	215,205	In-water
Greenbelt Boat Basin, Clarkston – Lower Granite Reservoir	1997/98	Recreation	5,601	In-water
Port of Lewiston – Lower Granite Reservoir (Port)	1997/98	Navigation	3,687	In-water
Port of Clarkston – Lower Granite Reservoir (Port)	1997/98	Navigation	12,154	In-water
Lower Granite Navigation Lock Approach	1997/98	Navigation	2,805	In-water
Lower Monumental Navigation Lock Approach	1998/99	Navigation	5,483	In-water

Dredging Location	Year	Purpose	Amount Dredged [cubic yards (cy)]	Disposal
Lower Monumental Navigation Lock Approach	2005/06	Navigation	4,583	In-water
Lower Granite Navigation Lock Approach	2005/06	Navigation	342	In-water
Port of Lewiston	2005/06	Navigation	7,744	In-water
Port of Clarkston	2005/06	Navigation	19,896	In-water
Confluence of Clearwater and Snake Rivers (Corps)	2005/06	Navigation	538,052	In-water

3. Project Description

3.1. Authority

The Corps was authorized by Congress to maintain a 14-foot-depth for navigation in the Flood Control Act of 1962 (Public Law 87-874)]. The Corps is working to develop methods to maintain navigation, while avoiding or minimizing negative impacts to the environment and adverse effects to ESA-listed species.

3.2. Project Area and Action Area

3.2.1. Action Area

The area directly affected by the proposed action begins near Lewiston, Idaho and Clarkston, Washington at the confluence of the Snake and Clearwater Rivers (approximately RM 139 on the Snake River), and extends downstream to the downstream navigation lock approach at Ice Harbor Dam (approximately Snake RM 10). The action area also extends upstream from the confluence of the Clearwater and Snake Rivers to around RM 1.2 on the Clearwater River. Both adult and juvenile life stages of ESA-listed Snake River spring/summer (SRSS), SRF Chinook, Snake River Basin (SRB) steelhead and Snake River (SR) sockeye salmon, as well as adult Columbia Basin bull trout use the action area as a migration corridor. The action area also provides spawning and rearing habitat for SRF Chinook salmon, although very little SRF Chinook salmon spawning occurs in the mainstem of the lower Snake River below the Snake and Clearwater Rivers confluence. Some adult SRB steelhead and juvenile SRSS Chinook salmon also overwinter in the action area.

Table 2 lists the sites proposed for dredging in 2013 and 2014 and the estimated quantities of material to be removed from each site. Sediment is expected to continue to accumulate at these locations while this action is being planned, therefore the amount of material to be removed at the time of the dredging will likely be greater than what is shown in Table 2. The Corps anticipates the quantity of material needing to be dredged will range from 422,000 cubic yards (cy) to a maximum of 500,000 cy.

Table 2 Sites Proposed for Immediate Maintenance Dredging

Site to be Dredged	Quantity to be Dredged (cy)[1]
Federal navigation channel at confluence of Snake and Clearwater Rivers (Snake RM 138 to Clearwater RM 2)	406,595
Port of Clarkston (Snake RM 137 and 139)	10,220
Port of Lewiston (Clearwater RM 1-1.5)	3,000
Ice Harbor Navigation Lock Approach (Snake RM 9.5)	1,950
Total	**421,765**

Note: [1] Based on removal to 16 feet below MOP using survey data from November 2011.

Confluence of Snake and Clearwater Rivers (Federal navigation channel). About 406,600 cy of material will be removed from the Federal navigation channel at the confluence of the Snake and Clearwater Rivers (Figures 2 and 3).

Currently at locations in front of port berthing areas, the Federal navigation channel is expanded up to a maximum total width of 950 feet. This widening is provided to allow for maneuvering of barge tows in accordance with navigation practice described in 33 U.S.C. § 562, "Channel dimensions specified shall be understood to admit of such increase at the entrances, bends, sidings, and turning places as may be necessary to allow for the free movement of boats."

Sediment samples were collected in August 2011 from the main navigation channel in the confluence area. The average percent sand and fines (i.e., small particles of sediment, generally silts and clays) from the 2011 samples was 100 percent and 0 percent, respectively.

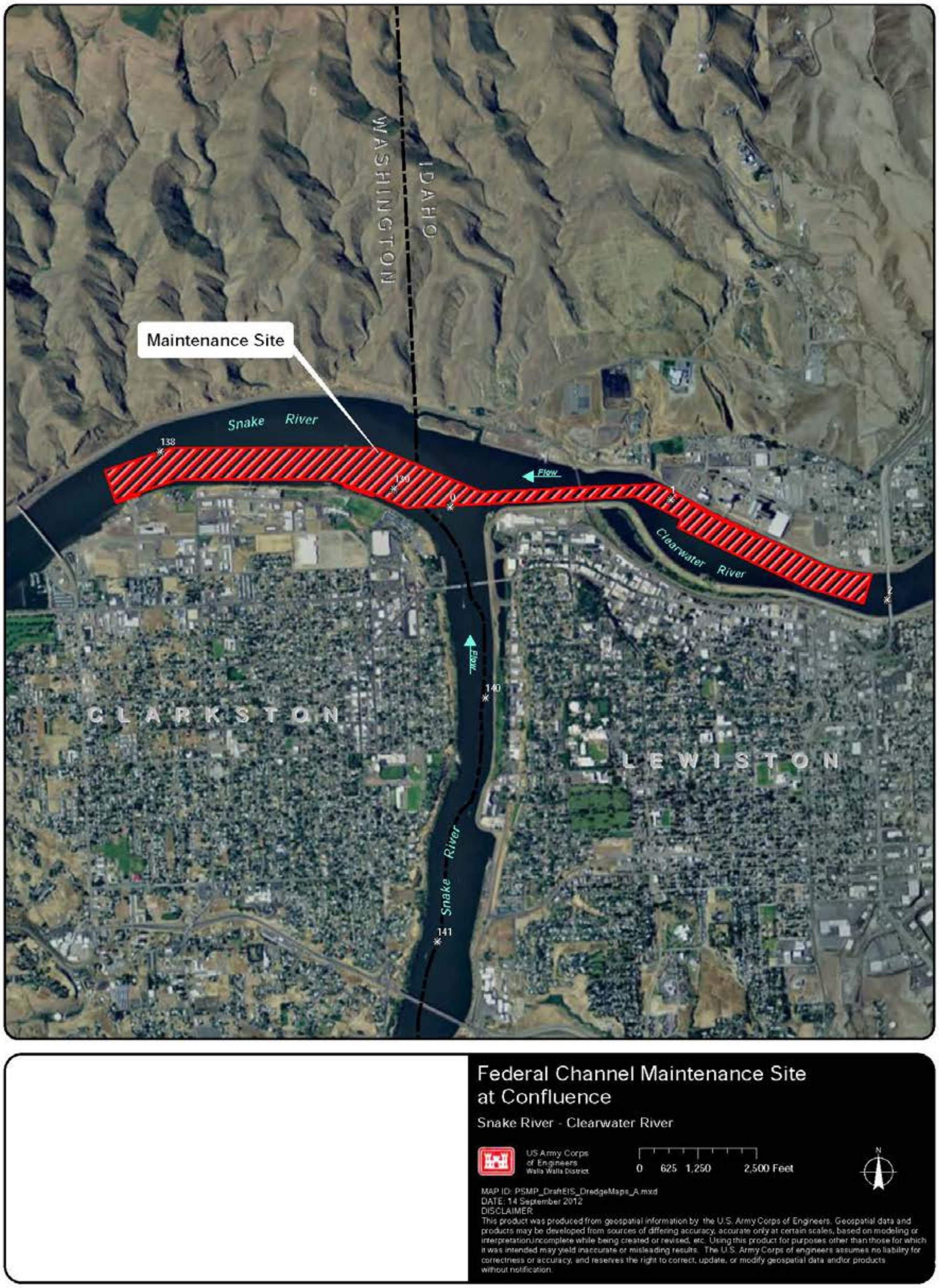

Figure 2 Federal Navigation Channel near Clarkston, WA and Lewiston, ID.

Figure 3 Shallow areas (less than 14 feet at MOP) within the Federal navigation channel and port berthing areas.

Port of Clarkston. About 10,200 cy of material will be removed from two berthing areas at the Port of Clarkston, the crane dock at the downstream end of the Port property and the tour boat dock at the upstream end (Figure 4). The berthing area is defined as a zone extending 50 feet out into the river from the port facilities and running the length of the port facilities. Maintenance in this area is the port's responsibility, and the Port of Clarkston will provide funding to the Corps for this portion of the work. Most of the area was last dredged in 2005/2006. Sediment surveys in 2011 showed that sediment composition was primarily of 86- to 99-percent sand and 1- to 14-percent fines.

Figure 4 Port of Clarkston dredging areas.

Port of Lewiston. About 3,000 cy of material will be removed from the berthing area at the Port of Lewiston (Figure 5). The berthing area is defined as a zone extending 50 feet out into the river from the port facilities and running the length of the port facilities. Maintenance in this area is the port's responsibility, and the Port of Lewiston will provide funding to the Corps for this portion of the work. The area was last dredged in 2005/2006. Sediment surveys in 2011 showed that sediment composition was similar to that found at the Port of Clarkston.

Figure 5 Port of Lewiston dredging area.

Ice Harbor Lock Approach. About 1,950 cy of material will be removed from the Ice Harbor lock approach (figures 6 and 7). Dredging has not occurred in this area since the 1970's. Sediment sampling showed that sediment composition was large rock substrate and cobbles greater than or equal to 2-6 inches.

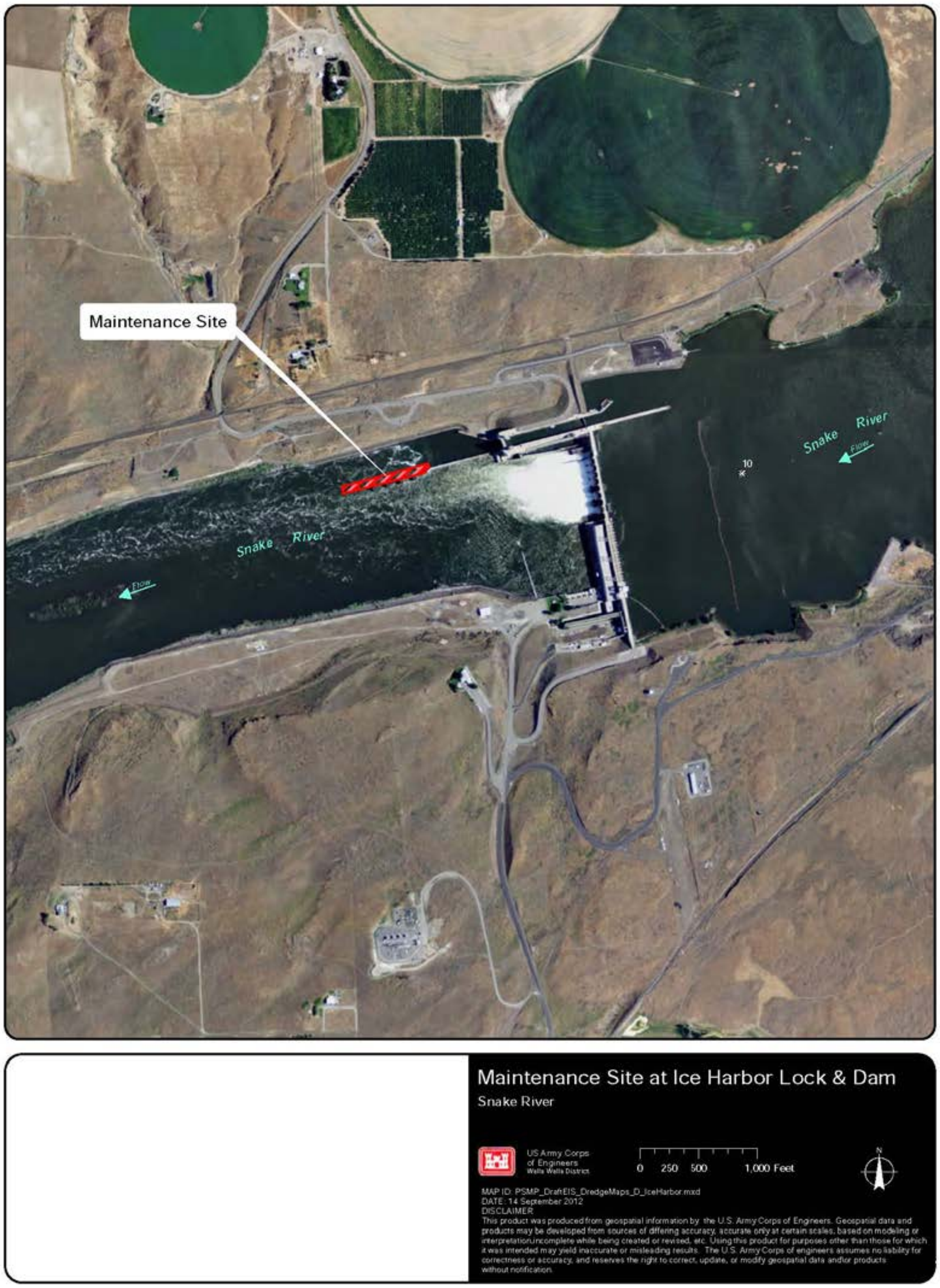

Figure 6 Dredging location at Ice Harbor navigation lock approach.

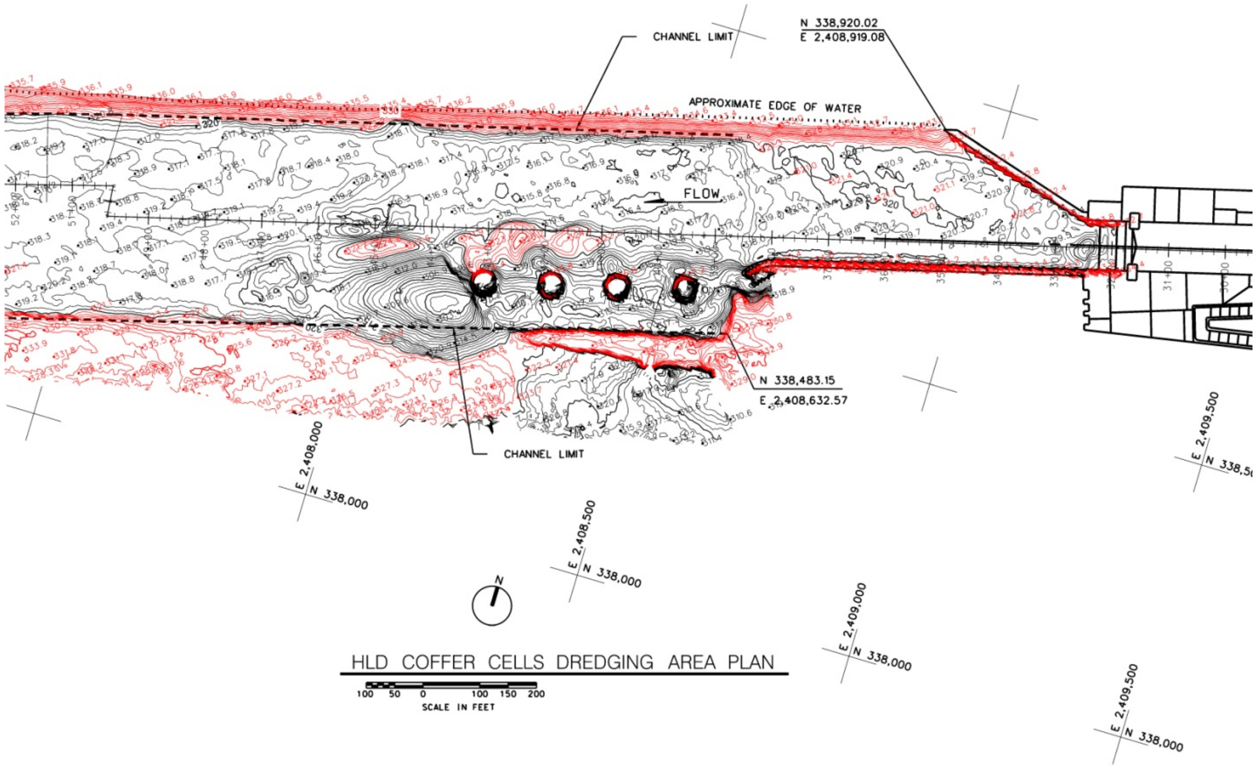

Figure 7 Shoaling at Ice Harbor navigation lock approach. Areas less than 14 feet deep at MOP are in red.

3.2.2. HUC, Township, Range, Section

USGS Hydrological Unit Codes (HUC) for this action include the Clearwater (17060306), the Lower Snake-Tucannon (17060107) and Lower Snake River (17060110) which are all designated as current essential fish habitat (EFH) for Chinook and currently accessible, but unutilized historic habitat for coho and the Lower Snake-Asotin (17060103) which is designated as currently accessible, but unutilized historic habitat for both Chinook and coho salmon.

The project footprint follows the Snake and Clearwater Rivers from Section 31 of Township 36 North, Range 5 West to Section 24 of Township 9 North, Range 31 East.

3.2.3. Quantification of Area Potentially Affected

Dredging will be aimed at restoring the navigation channel to the authorized depth by dredging to a depth of no more than 16 feet as measured at MOP. The overdepth dredging (i.e., to 16 feet) is standard procedure as outlined in Engineer Regulation 1130-2-520, *Project Operations – Navigation and Dredging Operations and Maintenance Policies* (USACE 1996). Overdepth allowance helps minimize the need for more frequent and intermittent dredging of high spots. A 16-foot depth is used as the maximum dredging depth in the Federal navigation channel in order to maintain a consistent 14-foot depth. Of the additional 2 feet, 1 foot is considered advance maintenance, which is the additional depth or width specified to be dredged beyond the project channel dimensions for the purpose of reducing overall maintenance costs and impacts by decreasing the frequency of dredging. The other foot is considered allowable overdepth, which is the additional depth below the required section specified in a dredging contract, and is permitted because of inaccuracies in the dredging process (USACE 1996).

The specific areas to be dredged were previously discussed (above). A total area of more than 50 acres of river bottom will be affected by the dredging. Another 26 acres will be directly affected at the disposal site. Some sand and silt will be carried a short distance downstream of these disturbed areas. The work will be distributed over 130 miles of river (from just below Ice Harbor Dam to Lewiston, ID with most of the work occurring from Snake RM 116 to 139.

3.3. Project Purpose and Objectives

The purpose of the routine channel maintenance is to provide a 14-foot depth throughout the designated Federal navigation channel in the project area and to restore access to selected port berthing areas. Sediment deposition can affect uses of the lower Snake River by building up on the existing bottom, thus reducing the water depth. Sediment deposits that create shallow-water areas are called shoals. Because routine channel maintenance has not occurred since 2005/2006, shoaling in the channel has become critical in some locations. There is a safety hazard if the water depth over the shoal is less than that shown on navigation charts, as vessels striking the shoal may become grounded and be damaged.

Groundings could result in the leakage or loss of cargo into the river, possibly presenting serious environmental consequences or concerns since petroleum products and fertilizer are among the top five commodities carried on the Snake and Columbia Rivers.

3.4. Project Description

3.4.1. Project Activities

The Corps proposes to perform maintenance dredging in 2013/2014 to meet the immediate need of providing a 14-foot water depth as measured at MOP at four locations in the lower Snake River and lower Clearwater River. The Corps identified a location in the Lower Granite reservoir, RM 116 just upstream of Knoxway Canyon, as the in-water discharge site of the dredged materials. The Corps proposes to use the dredged material to create additional shallow water habitat for juvenile salmonids. The material at the Ice Harbor navigation lock approach will be removed first. It will be placed on the bottom of the disposal area then the equipment will move up to the Clarkston/Lewiston sites.

Sediment Removal Methods

Dredging will be accomplished by a contractor using mechanical methods, such as a clamshell, dragline, or shovel/scoop. Based on previous dredging activities, the method to be used will likely be a clamshell. Material will be dredged from the river bottom and loaded onto barges for transport to the disposal site (see figure 8). Clamshell dredges with a capacity of approximately 15 cy and barges with capacity of up to 3,000 cy and maximum drafts of 14 feet will be used. It will take about 6 to 8 hours to fill a barge. The expected rate of dredging is 3,000 to 5,000 cy per 8-hour shift. The contractor could be expected to work up to 24 hours per day and 7 days per week if needed. Material will be scooped from the river bottom and loaded onto a barge, most likely a bottom-dump barge. While the barge is being loaded, the contractor will be allowed to overspill excess water from the barge, to be discharged a minimum of 2 feet below the river surface. Water quality monitoring will take place upstream (for background) and downstream of the dredge (as described in a monitoring plan for this project). The data will be collected near real-time so that timely measures can be taken to avoid exceeding both Washington and Idaho state water quality standards. These are the same procedures used during the previous dredging action in 2005/2006.

Disposal Site

Once the barge is full, a tugboat will push it to the disposal site. No material or water will be discharged from the barge while in transit. For in-water disposal, when the barge arrives at the disposal site and is properly positioned, the bottom will be opened to dump the material all at once. Once unloaded, the barge will be returned to the dredging site for additional loads.

The proposed in-water discharge/habitat development site is located in the Lower Granite reservoir at Snake RM 116 (Knoxway Canyon site). This site is an approximately 120-acre, mid-depth bench on the left bank of the Snake River about 0.5 river miles upriver of Knoxway Canyon. The Knoxway Canyon site was historically an old homestead orchard and pasture located several hundred feet upland of the historic river shoreline. The beneficial use site is located in a low velocity area that has been accumulating sediment at an estimated rate of 2 inches per year since the filling of Lower Granite reservoir. The substrate at this site was visually inspected in 1992 during the reservoir drawdown test and was observed to be primarily silt. The upstream end of the site was used as the in-water disposal site for the 2005/2006 navigation maintenance dredging. Approximately 420,000 cubic yards of sand and silt was deposited on the upriver end of the Knoxway bench. An estimated 3.7-acre shallow water habitat shelf was created for summer rearing juvenile fall Chinook salmon (Figure 8). The upper surface of this material is sand that was reshaped to gently slope towards the river.

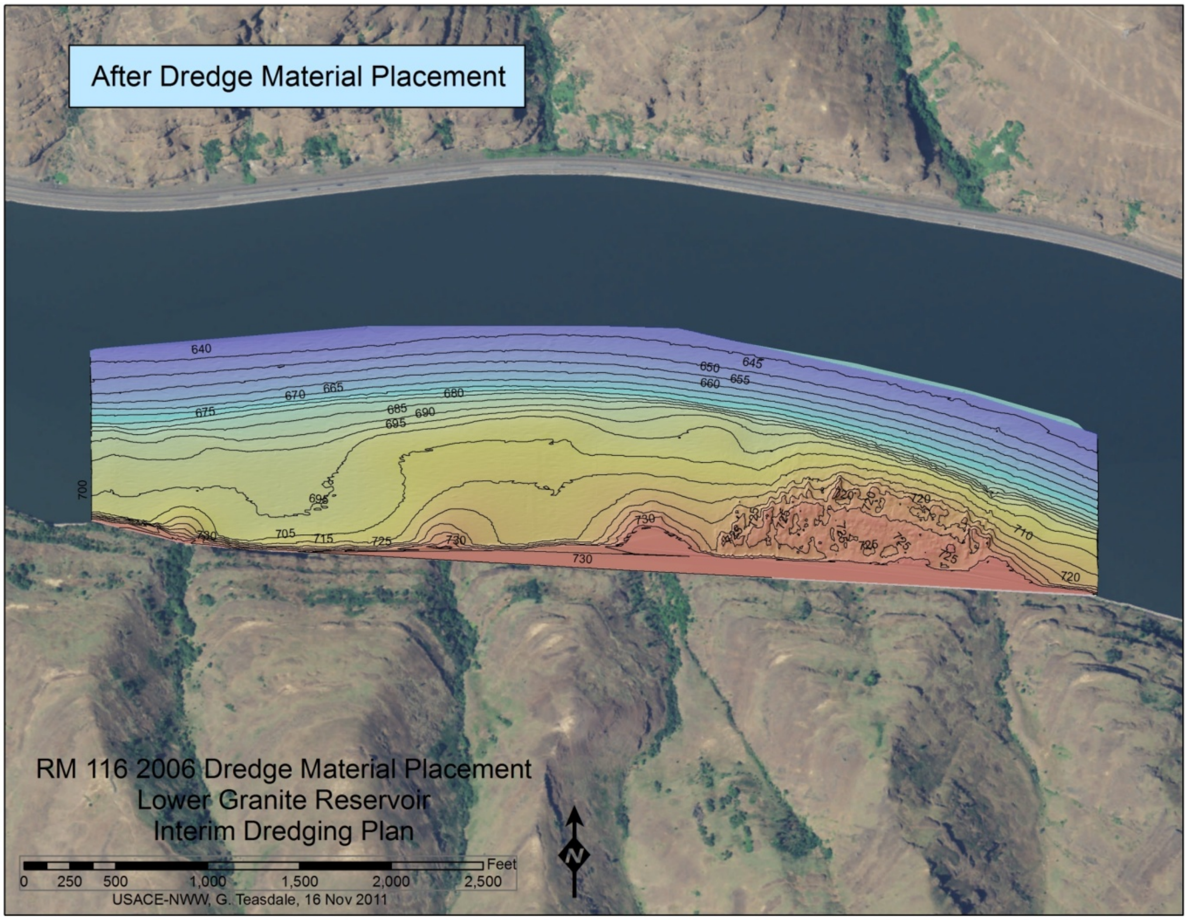

Figure 8 Contour map of RM 116 disposal site at Knoxway Canyon.

The material from the proposed 2013/2014 dredging will be deposited adjacent to and downstream of the material deposited in 2005/2006 (Figure 9). The new material will occupy a 26-acre footprint and will form a uniform, gently sloping shallow-water bench along about 3,500 linear feet of shoreline. The top of the bench will have a 2% slope and will provide about 7.36 acres of additional aquatic habitat up to 6 feet deep at MOP with features optimized for resting/rearing of outmigrating juvenile salmonids, particularly for SRF Chinook salmon (Figure 10). The Corps anticipates there will be about 18 acres of lesser-quality shallow water habitat at depths of 6 to 20 feet on the slope of the bench.

The overall plan is to place the dredged material in the below-water portion of the bench extending downriver from the material deposited in 2006 and riverward of the existing shoreline. However, rather than place the material in a block as was done in 2006, the Corps will place the material in a “ribbon” along the shoreline. This placement approach is based on results of recent biological surveys (Tiffan and Conner 2012, Artzen et al. 2012; Tiffan and Hatten 2012). These results indicate that a more useful design for the shallow water habitat will be to place the sand and silt material into a narrow band with a width of about 50 feet and a surface plane depth of 6 feet at MOP elevation 733 feet that parallels the shoreline. Placement of cobbles, rock, silt, and silt/sand mixture will occur in a manner that will extend the shore riverward along the proposed disposal site to enhance the rearing suitability of the mid-depth habitat bench, by creating a low horizontal slope across the newly created shallow-water rearing habitat. Final grading or reshaping to achieve the target slope will occur, if necessary, once disposal of all dredge material is complete.

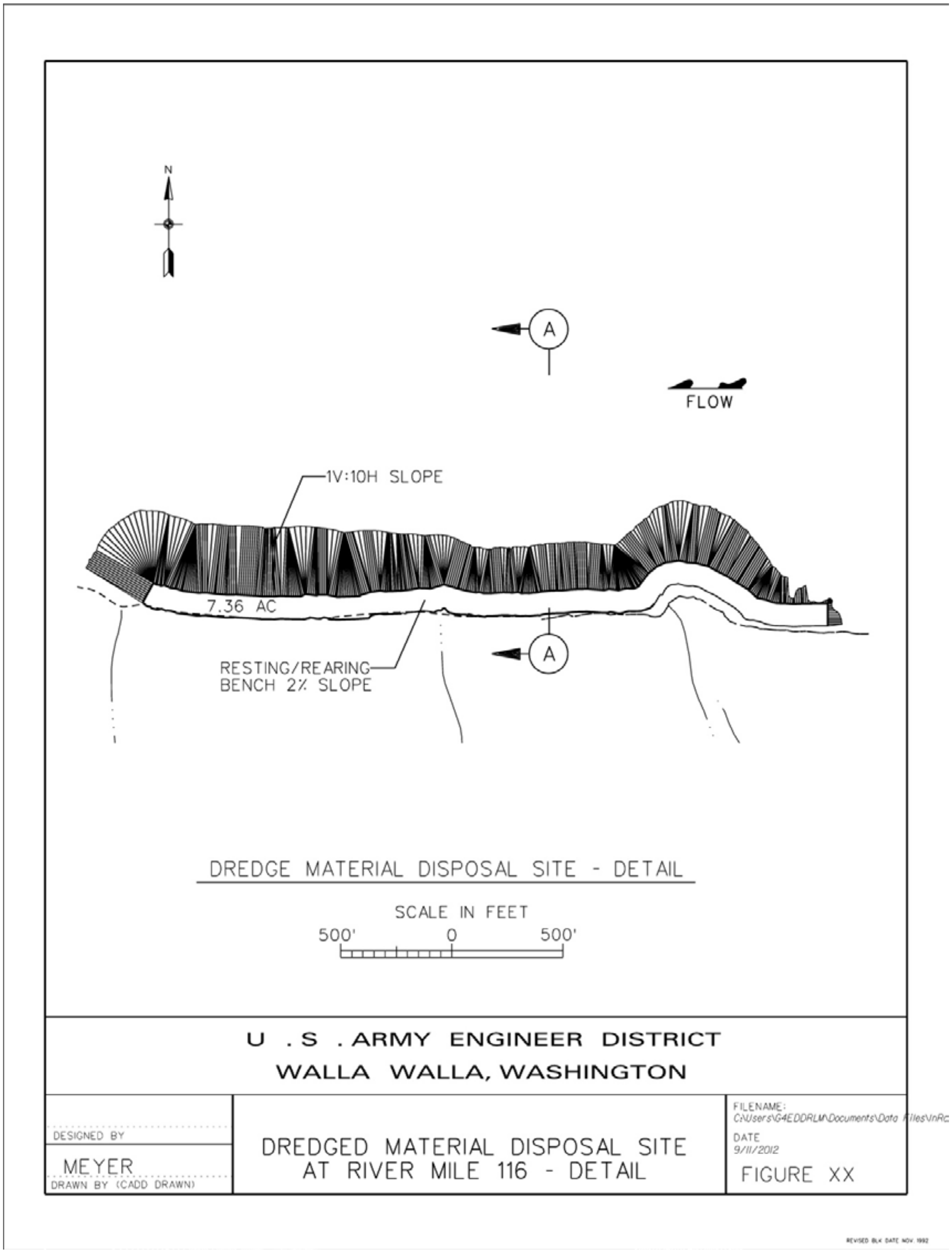

Figure 9 Site plan for disposal at RM 116.

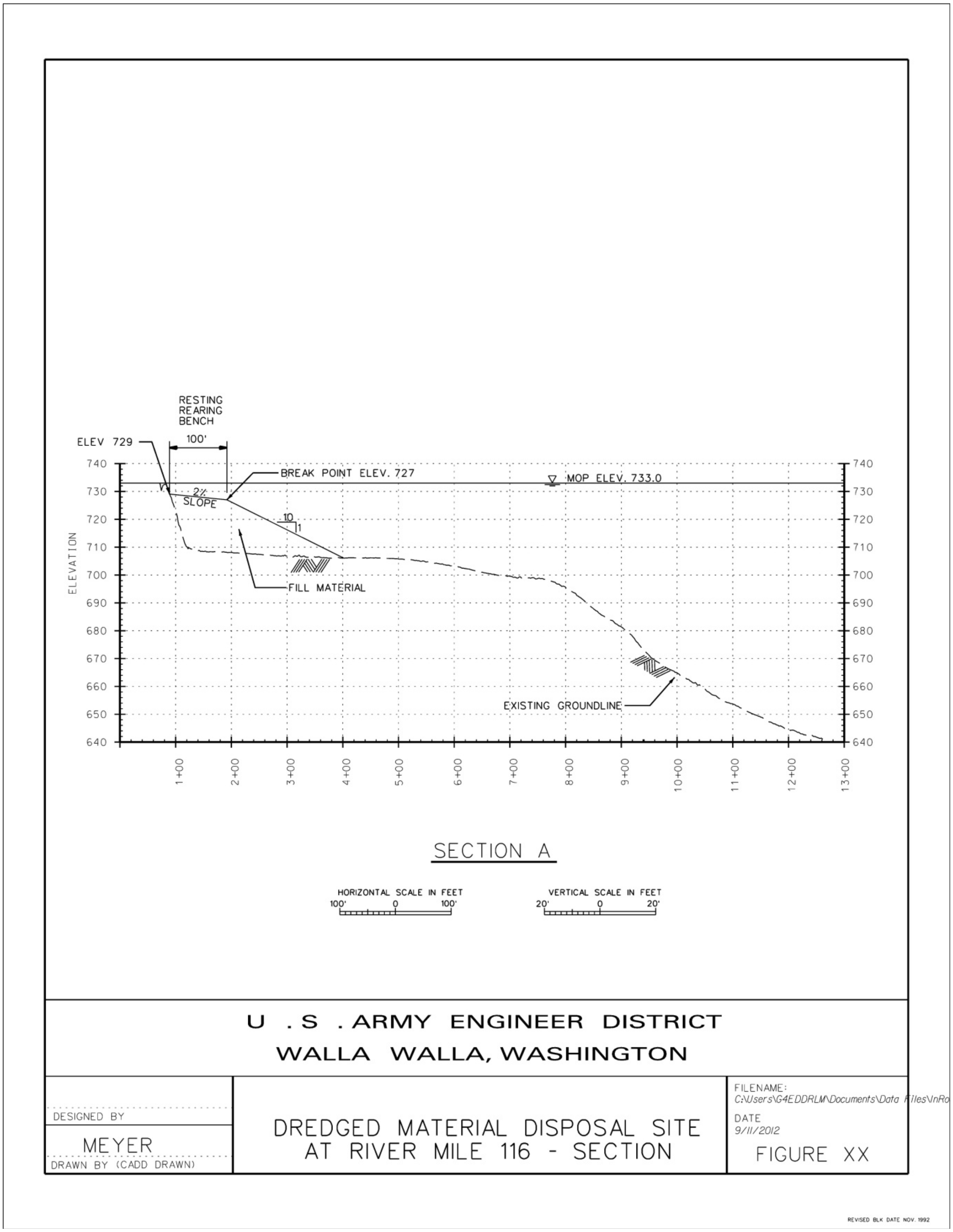

Figure 10 Cross section of disposal at RM 116.

During the 2005/2006 dredging project several water quality parameters were monitored in near real-time. Turbidity was the principal parameter that was influenced by the dredging activity in the Snake River. Turbidity values measured in the field were compared to background values and action levels were defined by the states' established criteria. The Port of Lewiston monitoring station did not report any turbidity values (hourly averages) above the State of Idaho water quality criteria of 50 Nephelometric Turbidity Units (NTU) units above background. For the remaining sites located in the State of Washington, there were some readings which exceeded the background reading average by 5 NTU units, the State of Washington Ecology Department water quality criteria.

The Corps proposes to monitor water quality, biological effects and structural stability of the disposed material in associations with the navigation channel maintenance dredging at four locations in the lower Snake River and lower Clearwater River in Washington and Idaho. This plan includes water quality monitoring that has been historically required for maintenance dredging projects in the lower Snake River as well as addressing concerns raised in previous ESA consultations. These concerns include viability of fish habitat and stability of the disposal embankment. Additional monitoring requirements may be identified in the Section 401 Water Quality Certification the Corps is requesting from Washington Department of Ecology or the short term activity exemption the Corps is requesting from Idaho Department of Environmental Quality. The Corps intends to issue one or more reports presenting the results of the monitoring. All the Corps' monitoring activities described in this plan may be conducted either by the Corps or its contractors, based on the availability of funds.

Monitoring will be conducted pre-dredging, during dredging and disposal and post-dredging and disposal. Pre-dredging includes redd surveys within the Ice Harbor navigation lock approach. Based on multiple years of surveys since 1993, no redds have ever been found within the navigation lock approaches of any of the lower Snake River dams (Mueller and Coleman 2007, Mueller and Coleman 2008). Since potential spawning habitat exists within the footprint of the proposed dredging area of the Ice Harbor Dam tailrace, the proposed action may have the potential to disturb or harm eggs and alevins in redds if found to be present immediately prior to or during the proposed dredging activities. In an effort to avoid disturbing or harming fall Chinook redds, the Corps will conduct underwater surveys of the proposed dredging site at the Ice Harbor navigation lock in November and the first 2 weeks of December in 2013 prior to commencing dredging. Techniques similar to those used by Battelle from 1993 to 2008 (Dauble et al. 1994-1997; Mueller and Coleman 2007, 2008) will be employed. This technique has used a combination of a boat mounted underwater video camera tracking system to look at the bottom of the river to identify redds. Results of the surveys will be transferred to the Corps within 2 days of the survey dates in order for compilation prior to December 15, at which time the Corps can communicate results to NMFS for appropriate action. If no redds are located, then the Corps will proceed with proposed dredging within the boundaries of the surveyed template. If one or more redds are located within the proposed dredging template and such redds are verified with video, then the Corps will coordinate with NMFS to determine what the appropriate avoidance and protection actions should be prior to dredging the affected location.

Pre-dredging also includes rearing habitat and site use surveys. The Corps has conducted multiple years of biological surveys within the lower Snake River including at the proposed RM 116 disposal site to determine current usage by juvenile salmonids, potential usage as rearing habitat by fall Chinook, and the efficacy of in-water disposal of dredged material for creating juvenile fall Chinook resting and rearing habitat in the lower Snake River reservoirs. The results of this research have shown that the use of dredged material to create shallow-water habitat has not adversely affected salmonid species and after stabilization provides suitable salmonid rearing and shallow habitat functions (Gottfried et el. 2011). These newly built shallow water areas were found to be at least as productive for invertebrates as compared to reference sites, provide beneficial shallow water habitat for natural subyearlings during the spring and summer (i.e., rearing fall Chinook), minimized the presence of predators at that site, and in general made the reservoir environment more hospitable for the Chinook salmon using it (Artzen et al. 2012; Gottfried et al. 2011; Tiffan and Conner 2012).

During the dredging and disposal activities, the Corps will monitor water quality to ensure state criteria are not being exceeded. The Corps will monitor depth, turbidity, pH, temperature, dissolved oxygen, and conductivity. Water quality monitoring will be performed before, during, and after all in-river work at each active dredging site and at the disposal site. The equipment will have the capability to transmit the data via satellite or radio relay rather than having to be downloaded at each station in the field.

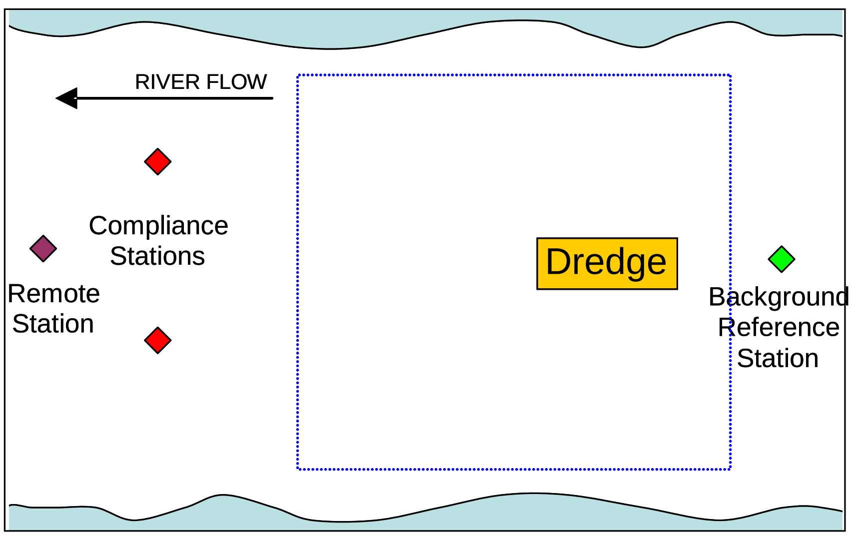

Figure 11 Schematic of water quality monitoring locations.

Biological monitoring includes fish monitoring. The Corps' contractor will monitor for sick, injured, or dead fish. They will visually monitor the waters surrounding the dredging and disposal activities as well as observing the content of each clamshell bucket as it discharges in the barges. If a sick, injured, or dead specimen is encountered, it will be placed in a container of cold river water until it could be determined if it was a species listed under the ESA. If it is a listed species, the contractor will notify the Corps and the Corps will then contact the appropriate Service as soon as possible for further instructions. If a healthy fish gets entrained by the dredging operations, the Corps will make every reasonable attempt to return the specimen safely back to the river.

Post-dredging and disposal will include hydrographic surveys to ensure the disposal site is constructed as planned. The Corps will perform follow up surveys after the first spring runoff following disposal.

Additional biological monitoring will be conducted post-dredging. Use by juvenile salmonids of the newly created habitat at the disposal site will be conducted. The Corps will collect fish use monitoring 2 years and 10 years after the project is complete (subject to the availability of funding).

Monitoring embankment stability will be accomplished by taking soundings soon after disposal is complete. Soundings will again be taken in the summer after high flows in order to determine if the embankment slumped or moved. This information will be used to make adjustments in the percentage of silt allowable for potential future dredged material placement, and to determine whether or not a berm should be constructed around the toe of the embankment to prevent movement. Monitoring of the biological use of the embankment will be accomplished by sampling fish species presence and abundance in the area post-construction.

3.4.2. Project Elements

The project includes the following main elements.

1. Mobilization of equipment to the Ice Harbor navigation lock approach.
2. Dredging of the approach.
3. Movement of equipment and dredged material up to the Knoxway Canyon disposal site.
4. Placement of the dredged rock at the disposal site.
5. Movement of equipment to the Clarkston/Lewiston dredging sites.
6. Dredging in the Federal navigation channel, the Port of Lewiston and the Port of Clarkston.
7. Transfer of dredged material to the disposal site at Knoxway Canyon.
8. Water quality monitoring at the dredging and disposal sites.
9. Redistribution of material at the disposal site to create a “ribbon” of shallow water habitat along the shoreline.
10. Surveying of the dredging and disposal sites to ensure required depths are met.
11. Demobilization of equipment when all dredging and disposal is complete.
12. Monitoring embankment stability
13. Fish use monitoring

3.5. Project Timeline

Under the proposed action all dredging and disposal action will occur during the in-water work window from December 15 to March 1. This in-water work window was established through coordination with state and Federal resource agencies as the time period in which in-water work could be performed with the least impact to ESA-listed salmonid stocks.

3.6. Project Sequence

Dredging will begin at the Ice Harbor site then move upriver to the Clarkston/Lewiston sites. Material will be dredged from the river bottom and loaded onto barges for transport to the disposal site. It will take about 6 to 8 hours to fill a barge. The expected rate of dredging is 3,000 to 5,000 cy per 8-hour shift. The contractor could be expected to work up to 24 hours per day and 7 days per week in order to ensure all work is completed during the in-water work period. While the barge was being loaded, the contractor will be allowed to overspill excess water from the barge, to be discharged a minimum of 2 feet below the river surface.

Once the barge is full, a tug will push it to the disposal site. Once unloaded, the barge will be returned to the dredging site for additional loads. All dredging will be performed within the established in-water work window (December 15 through March 1). Multiple-shift dredging workdays will be used when necessary to ensure that dredging was completed within this window.

At the disposal site, the dredged material will be placed in steps. The first step will be to place the cobbles from the Ice Harbor lock approach either on the surface of the disposal site or along the outer edge of the planned footprint to form a berm. This will be followed by placing a mixture of the silt (less than 0.0024 inch in diameter), sand, and gravel/cobble, to fill the mid-depth portion of a site and form a base embankment. The dredged material will be transported by barge to the disposal area, where the material will be placed within the designated footprint. This footprint will be close to the shoreline, so that the river bottom could be raised to create an underwater shelf about 10 feet below the desired final grade. Because the barges may not be able to dump in the shallow depths, additional equipment will likely be needed to place or reshape the material to bring it up to the desired finished grade and slope. This may be accomplished by using hydraulic placement of material, which involves pumping the material from the barge through a pipe or hose to the surface of the disposal site and guiding the pipe so the material is placed where needed. It may also be accomplished by using equipment such as a clamshell bucket to move the material to meet the desired configuration.

The final step will be to place sand on top of the sand/silt embankment. An area of sand will be reserved as the final area to be dredged during the dredging activity. Sand will be placed on top of the base embankment in sufficient quantity to ensure that a layer of sand at least 10 feet thick covers the embankment once the final step of the process was completed. As described above, the sand could be placed using hydraulic placement or mechanical equipment. The final step includes placement or re-handling of the material to form a gently-sloping (3 to 5 percent) shallow area bench with water-ward edge depths down to 6 feet, finished on top of a stable base slope down to 20 feet deep, both measured at MOP. The sand cap layer will be created with a minimum thickness of 10 feet to ensure that the most desirable substrate (sand with limited fine-grained or silt material) was provided for salmonid-rearing habitat.

Monitoring embankment stability will be accomplished by performing hydrographic surveys soon after disposal was complete and periodically in the future to determine if the embankment slumped or moved.

3.7. Operational Characteristics of the Proposed Action

The proposed action will not change any operations of hydrosystem facilities that underwent the formal consultation process in the 2008 Federal Columbia River Power System (FCRPS) BiOp and 2010 Supplemental BiOp. The relevant operational characteristics of the proposed action will be decreased water velocity through the dredged sediment removal site in the confluence and relatively no change in water velocity through the new rearing habitat at the Knoxway Canyon disposal site. No other operational changes to the system are expected.

3.8. Proposed Conservation Measures

The Corps proposes the following conservation measures as part of the proposed action. Conservation measures are intended to minimize or avoid environmental impacts to listed species or critical habitat. Conservation measures are incorporated into the initial Project design as a proactive means for avoiding or minimizing adverse impacts associated with Project activities. The conservation recommendations listed below are consistent with obligations to ESA compliance for dredging and disposal operations as well as for the survival and recovery of ESA-listed Snake River salmonid ESUs and DPS. Therefore, the conservation measures listed below will be implemented by the Corps to avoid or minimize adverse effects to the survival and recovery of Snake River sockeye salmon, SRF Chinook salmon, SRSS Chinook salmon, SRB steelhead, and bull trout, including adverse effects on designated critical habitat for these species.

- The Corps will, encourage other Federal agencies with applicable authorities or programs to reduce sedimentation in the Snake River Basin.

- The Corps will further investigate and pursue opportunities to enhance shallow-water rearing habitat.

3.8.1. Impact Minimization Measures

The following impact minimization measures will be implemented by the Corps:

1) Dredging activities may commence no earlier than December 15 and conclude not later than March 1.
2) Equipment will be inspected for leaks and cleaned prior to working. Any detected leaks will be repaired before the work begins.
3) A spill prevention and control plan will be developed and discussed to equipment operating personnel prior work.
4) A survey for redds will occur below the Ice Harbor navigation lock prior to dredging. If SRF Chinook salmon redds are discovered, the Corps will notify NMFS. The two agencies will jointly determine the appropriate course of action.
5) Water quality monitoring will be conducted at the dredging and disposal sites in near real-time so that operational changes can occur rapidly if water quality standards are exceeded.

6) Dredging activities will be concluded in a single in-water work period.

3.8.2. Best Management Practices

Typical types of best management practices will depend on site-specific conditions, but will generally include the following.

1) The Corps will minimize take from dredging and disposal operations by monitoring pre-, during, and post-dredging and disposal.
2) In-water disposal will only occur at the Knoxway Canyon site. Sediment will be disposed in a manner that will maximize its suitability as rearing habitat.
3) Sediment that contains concentrations of contaminants in excess of regulatory thresholds (none found) will be disposed of at an appropriate upland location.
4) The Corps will continue to evaluate the benefits of newly constructed habitat/in-water disposal sites. Specifically, the Corps will determine if new habitat locations function as rearing habitat for juvenile fall Chinook salmon, and will report the results of this evaluation to NMFS.
5) If the Corps or its contractor observes that a threatened or endangered species has been entrained by dredging operations, every reasonable attempt will be made to return the specimen safely back to the river. If a sick, injured, or dead specimen of a threatened or endangered species is observed, the finder must notify the Corps Contracting Officer or representative immediately. The Corps will then contact NMFS or USFWS.

3.9. Mitigation

3.9.1. Mitigation Required Under Other Permits

There is no mitigation required under other permits at this time.

3.10. Interdependent and Interrelated Actions

Interdependent actions are those that have no independent utility apart from the proposed action. Interrelated actions are part of a larger action and depend on the larger action for their justification.

Commercial barging has an interrelated and interdependent effect on ESA-listed species. Barges can leak petroleum products and possibly cargo into the river, which reduces water quality. When shallow water is encountered, barges can ground, or stir up sediments from the river bottom, also affecting water quality.

As part of meeting requirements of the 2008/2010 FCRPS BiOp, the Corps collects and transports juvenile salmonids arriving at certain lower Snake River, including Lower Granite Dam, through up to eight FCRPS dams for release below Bonneville Dam. The current barging system is dependent on a functioning transportation system to meet this FCRPS BiOp requirement. The 2008/2010 FCRPS BiOp contains a requirement to operate the dams at MOP. If the navigation channel is shallower than 14 feet the water level is increased to maintain commercial navigation. This, in turn, increases the travel time for juvenile salmon to migrate through Lower Granite Reservoir. Commercial industries which make up the cargo barges carry, such as timber and agricultural products are not dependent on barging (or dredging), as these products could be hauled by truck or rail.

4. Status of Species and Critical Habitat

4.1. Species Lists from NMFS and USFWS

On 25 September 2012 the Corps reviewed the current list of threatened and endangered species that pertain to the proposed project area under the jurisdiction of NMFS and USFWS for the following counties. Table 3 lists the species which may be in the counties where work could occur.

- Nez Perce County, ID
- Asotin County, WA
- Columbia County, WA
- Franklin County, WA
- Garfield County, WA
- Walla Walla County, WA
- Whitman County, WA

4.2. Identification of Listed Species and Critical Habitat

Table 3 Federal Register notices for final rules that list threatened and endangered species, designate critical habitats, or apply protective regulations to listed species considered in this consultation. Listing status: 'T' means listed as threatened under the ESA; 'E' means listed as endangered; "P" means proposed for listing or designation.

Species	Listing Status	Critical Habitat	Protective Regulations
Chinook salmon (*Oncorhynchus tshawytscha*)			
Snake River spring/summer run	T 6/28/05; 70 FR 37160	10/25/99; 64 FR 57399	6/28/05; 70 FR 37160
Snake River fall-run	T 6/28/05; 70 FR 37160	12/28/93; 58 FR 68543	6/28/05; 70 FR 37160
sockeye salmon (*O. nerka*)			
Snake River	E 6/28/05; 70 FR 37160	12/28/93; 58 FR 68543	ESA section 9 applies
steelhead (*O. mykiss*)			
Snake River Basin	T 1/05/06; 71 FR 834	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
bull trout (*Salvelinus confluentus*)			
Columbia River DPS	T 6/10/98; 63 FR 31647 31674	9/02/05; 70 FR 56211 56311: 10/18/10; 75 FR 63898	
pygmy rabbit (*Brachylagus idahoensis*)			
Columbia Basin DPS	E 11/30/01; 66 FR 59769 59771	None designated	
Canada lynx (*Lynx canadensis*)			
Contiguous U.S. DPS	T 3/24/00; 63 FR 16051 16086	2/25/09; 74 FR 8615 8702	
Ute ladies'-tresses (*Spiranthes diluvialis*)			
Contiguous U.S. DPS	T 1/17/92; 57 FR 2048 205	None designated	
Spalding's catchfly (*Silene spaldingii*)			
	T 10/10/01; 66 FR 51597 51606	None designated	

4.3. Identification of Designated Critical Habitat

Critical habitat has been designated for all of the fish species as well as Canada lynx.

4.4. Status of Species

4.4.1. Snake River Spring/Summer Chinook

4.4.1.1. Listing History

The Snake River SSChinook salmon ESU, listed as threatened on April 22, 1992, (67 FR 14653), includes all natural-origin populations in the Tucannon, Grande Ronde, Imnaha, and Salmon Rivers. Fish returning to several of the hatchery programs are also listed, including those returning to the Tucannon River, Imnaha, and Grande Ronde River hatcheries, and to the Sawtooth, Pahsimeroi, and McCall hatcheries on the Salmon River. Critical habitat was designated for SRSS Chinook salmon on December 28, 1993 (58 FR 68543), and was revised on October 25, 1999 (64 FR 57399).

4.4.1.2. Life History/Biological Requirements

In the Snake River, spring and summer Chinook share key life history traits. Both are stream-type fish, with juveniles that migrate swiftly to sea as yearling smolts. Depending primarily on location within the basin (and not on run-type), adults tend to return after either 2 or 3 years in the ocean. Both spawn and rear in small, high elevation streams (Chapman et al. 1991), although where the two forms co-exist, spring-run Chinook spawn earlier and at higher elevations than summer-run Chinook.

Spring/summer Chinook salmon use smaller, higher elevation tributary systems for spawning and juvenile rearing compared to fall run fish which spawn in mainstems of larger rivers. Spring/summer Chinook salmon normally spawn in late July–September using gravel bars in smaller river and tributary streams. As with most salmon, adults die after spawning providing a large nutrient source for juvenile fish. Juvenile spring/summer Chinook salmon behave differently than fall Chinook in that they remain in headwater streams for a year and out–migrate the following spring. Optimal water temperatures range from 14–19°C (57–66°F) with temperatures exceeding 21°C (70°F) being lethal (Wydoski and Whitney 2003). Juvenile Chinook salmon feed on small aquatic invertebrates in both fresh and salt water, primarily insects in freshwater and crustaceans in marine environments. As they grow in saltwater, they quickly change to a fish diet (IDFG 2005).

4.4.1.3. Distribution

Based on genetic and geographic considerations, the ICBTRT (2003) established five major population groups in this ESU: the Lower Snake River Tributaries, the Grande Ronde and Imnaha Rivers, the South Fork Salmon River, the Middle Fork Salmon River, and the upper Salmon River. The ICBTRT further subdivided these groupings into a total of 31 extant, demographically independent populations. However, Chinook salmon have been extirpated from the Snake River and its tributaries above Hells Canyon Dam, an area that encompassed about 50 percent of the pre-European spawning areas in the Snake River Basin. In 1927, major subbasins in the Clearwater River Basin were blocked to Chinook salmon by the construction of Lewiston Dam. Figure 12 shows the distribution of Chinook salmon in the Columbia River basin.

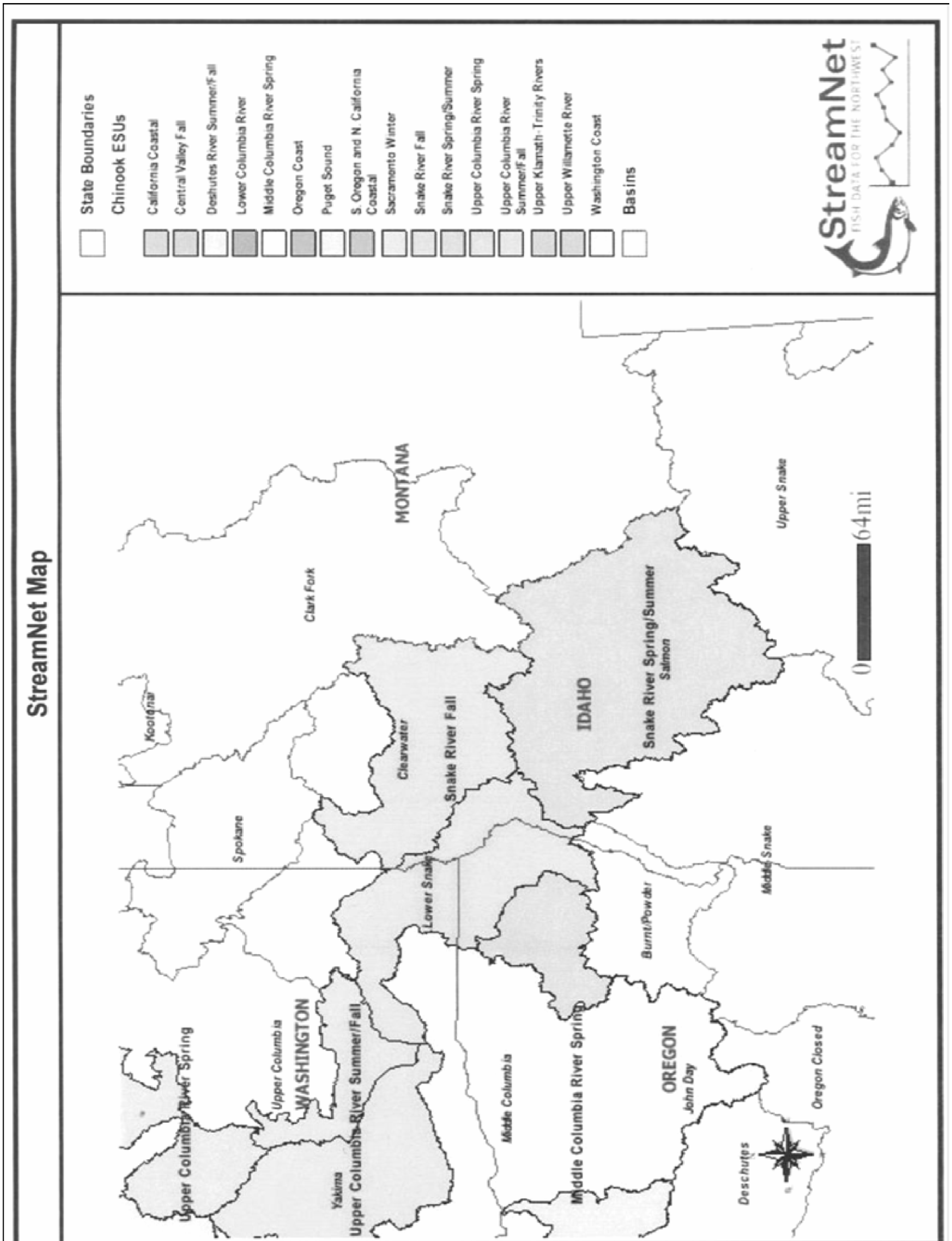

Figure 12 Columbia River basin Chinook salmon distribution.

4.4.1.4. Factors for Decline

4.4.1.4.1. Historical Pressures on the Species

Even before mainstem Snake River dams were built, habitat was lost or severely damaged in small tributaries by construction and operation of irrigation dams and diversions, inundation of spawning areas by impoundments and siltation and pollution from sewage, farming, logging and mining.

In 1927 major subbasins in the Clearwater River Basin were blocked to Chinook salmon by the construction of Lewiston Dam, which has now been removed. Tributary streams upstream of the Salmon River were completely blocked by the 1960's by construction of the Hells Canyon Complex. The lower Snake River dams have also impacted a portion of the remaining population. By the mid-1900s, the abundance of adult spring and summer Chinook salmon had greatly declined. As evidenced by adult counts at dams, however, spring and summer Chinook salmon have declined considerably since the 1960s though there has been an increase in recent years (FPC 2012).

4.4.1.4.2. Current Pressures on the Species

Factors such as injury while passing through dams, predation and high water temperatures continue to impact Snake River Chinook salmon. During the 2004 Status Review, NMFS evaluated whether conservation efforts (e.g., the extensive artificial propagation program) reduced or eliminated the risk to Snake River SS Chinook salmon. They concluded the artificial propagation programs did provide benefits in terms of abundance, spatial structure and diversity, but the programs had neutral or uncertain effects in terms of overall productivity. As a result, NMFS did not believe that the artificial propagation programs were sufficient to substantially reduce the long-term extinction risk. Actions under the FCRPS Biological Opinions and improvements in hatchery practices are addressing some factors for decline of this ESU.

4.4.1.4.3. Limiting Factors for Recovery

The limited amount of high quality habitat available is likely the main factor limiting recovery of SRSS Chinook salmon.

4.4.1.5. Local Empirical Information

4.4.1.5.1. Current Local Population Information

Juvenile spring Chinook salmon have been documented as using the backwater areas of Lake Wallula for rearing. Limited sampling has occurred in the lower Snake River demonstrating that individuals of SRSS Chinook salmon may show very limited use of shallow water areas of lower Snake River reservoirs for periods of rearing during the spring outmigration period or overwintering between July and March (Tiffan and Connor 2012; Artzen et al. 2012). Because this ESU is an upriver stock, no spawning habitat is present in the lower Snake River.

Juvenile SRSS Chinook salmon generally migrate through the Snake River during March through July. Most adult SRSS Chinook salmon migrate through the lower Snake River between April and mid-August.

There has been a general increase in the number of adult and jack SRSS Chinook passing over Ice Harbor Dam in recent years, though the latest years' data hasn't reached the peak of the number counted in 2001 (191,866). The latest 10 year average (2002- 2011) was 91,937. The previous 10 year average was 41,130 (FPC 2012).

4.4.1.5.2. Ongoing Monitoring

Passage of adult and juvenile Chinook salmon is monitored at the Snake River dams. There are also several other monitoring programs by other Federal, state and tribal organizations throughout the watershed.

4.4.2. Snake River Fall Chinook

4.4.2.1. Listing History

NMFS listed SRF Chinook salmon as threatened on April 22, 1992 (57 CFR 14653) and their threatened status was reaffirmed on June 28, 2005 (70 CFR 37160).

4.4.2.2. Life History/Biological Requirements

Detailed life history data (age at spawning, sex ratios, etc.) are plentiful for hatchery populations, but limited and inconsistent for wild populations. More data are also available for some subbasins and streams than others, and different types of data are available for different streams at different times. Age at spawning and associated fecundity differ between the adults returning to the Middle Fork and main Salmon Rivers and all other areas where information is available. In these two areas, 3-ocean adults (especially females) with higher fecundity predominate, whereas 2-ocean adults with lower fecundity predominate in other areas. This is in spite of the fact that spring- and summer-run Chinook salmon inhabit parts of both areas. This suggests that geography or other environmental factors are more influential in determining age at return than run-timing (Mathews and Waples 1991).

The generalized life history of Pacific salmon involves incubation, hatching, and emergence in freshwater, migration to the ocean, and subsequent initiation of maturation and return to freshwater for completion of maturation and spawning. Juvenile rearing in freshwater can be minimal or extended. Additionally, some male Chinook salmon mature in freshwater, thereby foregoing emigration to the ocean. The timing and duration of each of these stages is related to genetic and environmental determinants and their interactions to varying degrees. Salmon exhibit a high degree of variability in life-history traits; however, there is considerable debate as to what degree this variability is the result of local adaptation or the general plasticity of the salmonid genome (Ricker 1972, Healey 1991, Taylor 1991).

Juveniles emerge from the gravels in March and April of the following year, moving downstream from natal spawning and early rearing areas from June through early fall. Juvenile fall-run Chinook salmon move seaward slowly as subyearlings, typically within several weeks of emergence (Waples et al. 1991).

Adults return to the Snake River at ages 2 through 5, with age 4 most common at spawning (Waples et al. 1991). Adult SRF Chinook salmon enter the Columbia River in July and August and reach the mouth of the Snake River from the middle of August through October. Spawning occurs in the main stem and in the lower reaches of large tributaries in October and November.

4.4.2.3. Distribution

SRF Chinook salmon spawning and rearing occurs only in larger, mainstem rivers such as the Salmon, Snake, and Clearwater Rivers. Historically, the primary fall-run Chinook salmon spawning areas were located on the upper mainstem Snake River (Connor et al. 2005). A series of Snake River mainstem dams block access to the upper Snake River, which has significantly reduced spawning and rearing habitat for SRF Chinook salmon. The vast majority of spawning today occurs upstream from Lower Granite Dam, with the largest concentration of spawning sites in the Clearwater River, downstream from Lolo Creek. Currently, natural spawning is limited to the Snake River from the upper end of Lower Granite Reservoir to Hells Canyon Dam, the lower reaches of the Imnaha, Grande Ronde, Clearwater, Salmon, and Tucannon Rivers, and small areas in the tailraces of the lower Snake River hydroelectric dams (Good et al. 2005; Mueller and Coleman 2007). The tailrace of Ice Harbor Dam has been surveyed for fall Chinook redds during six years from 1993-2008 with one redd located below Ice Harbor Dam in 1996 and two in 2007 with none in the vicinity of the navigation lock approach. The area downstream of the navigation lock approach has a low suitability as fall Chinook spawning habitat (Mueller and Coleman 2007).

As a consequence of losing access to historic spawning and rearing sites in the upper Snake River, fall Chinook salmon now reside in waters that are generally cooler than the majority of historic spawning areas. In addition, alteration of the lower Snake River by hydroelectric dams has created a series of low-velocity pools in the Snake River that did not exist historically. Both of these habitat alterations have created obstacles to fall Chinook survival. Prior to alteration of the Snake River Basin by dams, fall Chinook salmon exhibited a largely ocean-type life history, where they migrated downstream and reared in the mainstem Snake River during their first year. Today, fall Chinook salmon in the basin exhibit one of two life histories that Connor et al. (2005) have called ocean-type and reservoir-type. The reservoir-type life history is one where juveniles overwinter in the pools created by the dams, prior to migrating out of the Snake River. The reservoir-type life history is likely a response to early development in cooler temperatures, which prevents juveniles from reaching a suitable size to migrate out of the Snake River.

While most SRF Chinook salmon spawn above the confluence and navigation lock approach area targeted for dredging, a few have been documented periodically (1993 and 1994 in the tailwaters of the lower Snake River dams) spawning within suitable areas of the tailwater environment outside the navigation lock approaches (Bennett et al. 1983, 1992; Dauble et al. 1994, 1995).

4.4.2.4. Factors for Decline

4.4.2.4.1. Historical Pressures on the Species

SRF Chinook salmon are believed to have once lived and spawned in the mainstem Snake River from its confluence with the Columbia River upstream to Shoshone Falls (RM 615). The spawning grounds between Huntington, Oregon (RM 328) and Auger Falls in Idaho (RM 607) were historically the most important for this species; and only limited spawning activity occurred downstream of RM 273 (Waples et al. 1991), about one mile below Oxbow Dam. However, development of irrigation and hydropower projects on the mainstem Snake River have inundated or blocked access to most of this area in the past century.

Construction of Swan Falls Dam (RM 458) in 1901 eliminated access to many miles (about 25 percent) of potential habitat, leaving only 458 miles of useable habitat. Construction of the Hells Canyon Dam complex (from 1958-1967) cut off anadromous fish access to 211 miles (or 46 percent) of the remaining historical fall Chinook salmon habitat upstream of RM 247. The lower Snake River Dams allow access to upriver areas, but have further changed the character of the remaining habitat.

4.4.2.4.2. Current Pressures on the Species

SRF Chinook salmon now have access to approximately 100 miles of mainstem Snake River habitat, which is roughly 22 percent of the 458 miles of historic habitat available prior to completion of the Hells Canyon Complex and the four lower Snake River dams. The limited amount of habitat limits the salmon population. These fish are also affected by passage through dams, high water temperatures, predation and poor estuary conditions.

The Snake River system has contained hatchery-reared fall Chinook salmon since 1981 (Busack 1991). The hatchery contribution to Snake River Basin escapement has been estimated at greater than 47% (Myers et al. 1998). Artificial propagation is relatively recent, so cumulative genetic changes associated with it may be limited. Wild fish are incorporated into the brood stock each year, which should reduce divergence from the wild population. Release of subyearling fish may also help minimize the differences in mortality patterns between hatchery and wild populations that can lead to genetic change.

4.4.2.4.3. Limiting Factors for Recovery

Approximately 80 percent of historical spawning habitat was lost with the construction of a series of dams on the mainstem Snake River. The loss of spawning habitat restricted the ESU to a single naturally spawning population and increased its vulnerability to environmental variability and catastrophic events. The diversity associated with populations that once resided above the Snake River dams has been lost and the impact of hatchery fish and fish from other areas straying to the spawning grounds has the potential to further compromise the genetic diversity of the ESU. Although recent improvements in the marking of hatchery fish and the removal of some of them at Lower Granite Dam have reduced the impact of many of these strays, introgression below Lower Granite Dam remains a concern. The Biological Review Team found moderately high risk for all viable salmon population categories and therefore felt that this ESU was at some level of risk despite the recent positive signs.

4.4.2.5. Local Empirical Information

4.4.2.5.1. Current Local Population Information

Adult SRF Chinook numbers passing over Ice Harbor Dam have increased in the last several years. The latest 10 year average (2002 – 2011) is 35,137. The previous 10 year average was 8,403 (FPC 2012).

Wild juvenile fall Chinook salmon typically pass through the Lower Snake River from mid-June through September, with double peaks in mid-July and some lingering portion of the annual migration lasting until December. Many of the juvenile fall Chinook salmon outmigrating from the Clearwater and Snake Rivers spend time in shoreline areas (less than 3 meters [9.8 feet] in depth) in the Lower Granite reservoir and less time in downriver reservoirs, where they prefer sand-substrate areas (Bennett et al. 1997). Tiffan and Connor (2012) similarly reported low gradient shoreline areas less than 2 meters deep were highly used by naturally produced juvenile fall Chinook salmon. When water temperatures reach about 21.1°C (70°F), these fish appear to have achieved adequate growth and fitness due to the warming conditions of these shallow-water habitat areas. They leave the shoreline areas to either continue rearing or begin their migration in the cooler pelagic zone of the reservoirs (Bennett et al. 1997).

Though most juvenile Chinook salmon migrate to the ocean as sub-yearlings, passive integrated transponder (PIT) tag detections from 1993 to 1995 brood year juvenile fall Chinook salmon from the Clearwater River were recorded in the spring of 1994 to 1996 at some lower Snake River dams. More PIT-tagged fall Chinook salmon outmigrants were detected in the spring of 1994 and 1995 than in the previous year, while the trend was reversed with the 1995 brood year. It is apparent from these detections that some Clearwater River fall Chinook salmon migrate to the ocean as yearlings, rather than as subyearlings.

The Snake River upper reach, Snake River lower reach, Grande Ronde River, and Clearwater River are recognized as the four major spawning aggregates of Snake River Basin natural fall Chinook salmon upstream of Lower Granite Reservoir (ICBTRT 2007). Though treated as one population, temperature during incubation and early rearing fosters life history diversity among the juveniles of the spawning aggregates (Connor et al. 2002, 2003a). Natural fall Chinook salmon in the Snake River upper reach typically emerge and enter Lower Granite Reservoir as subyearlings earliest followed in overlapping order by natural fall Chinook salmon subyearlings (hereafter, natural subyearlings) from the Snake River lower reach, Grande Ronde River, and finally the Clearwater River subbasin. Passage of natural subyearlings from the four spawning aggregates through the lower Snake River reservoirs is a protracted event (Connor et al. 2002) based on data collected on fish implanted with passive integrated transponder (PIT) tags (Prentice et al. 1990). Thus, there is large potential for natural subyearlings to use shallow water habitat complexes throughout the spring and summer.

Natural subyearlings most likely enter Lower Granite Reservoir as both newly emergent fry and as parr after they have reared upstream in natal riverine habitat. Those fish that enter the reservoir as fry probably locate nearshore areas and reside there as they grow to into parr. Fry abundance likely decreases over time due to mortality, recruitment to parr, and as fish move downstream. Natural subyearlings that remain in natal riverine rearing areas upstream of Lower Granite Reservoir are believed to progress through four migrational phases including: discontinuous downstream dispersal along the shorelines of the free-flowing river; abrupt and mostly continuous downstream dispersal offshore in the free-flowing river; passive, discontinuous downstream dispersal offshore in Lower Granite Reservoir; and, active and mostly continuous seaward migration (Connor et al. 2003b). Thus, the potential for use of shallow water habitat by natural fall Chinook salmon subyearlings is regulated by the dispersal of fry and parr as well as the survival and behavior of fish passing through these two life stages.

Some of the natural and hatchery subyearlings discontinue active migration before or after entering the reservoirs in mid-summer (Arnsberg and Statler 1995). These “reservoir-type” juveniles are primarily natural fall Chinook salmon (Connor et al. 2005) and they feed and grow as they move downstream offshore in reservoirs during fall and winter and into spring when they become yearlings (Tiffan et al. 2012). Winter is a critical season that can greatly influence the survival and behavior of juvenile anadromous salmonids. Fish in small streams limit their winter movement and energy expenditure by seeking nearshore cover and holding (review by Brown et al. 2011). Shallow water habitat in the lower Snake River reservoirs would also be important to overwinter survival of reservoir-type juveniles if they exhibited the behavior of their counterparts that inhabit small streams. However, Tiffan et al. (2012) hypothesized that the need for cover, protection from predators, and energy conservation are met in reservoirs in ways that allow fish more unrestricted movement at lower energetic costs than observed in small streams. Further, the same authors deduced from angling catch data that reservoir-type juveniles are largely pelagic. Furthermore, sampling data, including radio-telemetry efforts, suggests that use of shallow water habitat during the fall and winter by juvenile fall Chinook is limited and that while juveniles passed shallow water habitat sites, relatively few entered them. Radio-tagged fish located during mobile tracking in the winter of 2010 were pelagically oriented, and generally not found over shallow water or close to shore (Tiffan and Connor 2012).

Cold-water releases from Dworshak Dam, aimed at augmenting flows for adult migration, may cause stunted growth rates in juveniles in the late summer and early fall, causing these fish to overwinter. Overwintering and early rearing of fall Chinook salmon in Lake Wallula backwater areas has been documented and it will be logical to assume that the potential for overwintering and rearing exists in the lower Snake River as well.

Redd surveys have been performed in the lower Snake River since at least 1993 (Mueller 2009). For example, seven redds were found downstream of Lower Monumental Dam in 2008 by the Pacific Northwest National Laboratory (Mueller 2009). The redds were located approximately 30 meters (m) (100 ft) downstream of the fish bypass pipe and adjacent to the fish loading dock on the north side of the river in water depths of 4 to 5.5m (13 to 18 ft) with near bottom water velocities of 0.37 to 0.46 m/sec (1.2 to 1.5 feet per second (ft/s)). This was the first time that redds were found at this location (Arnsberg et al. 2009). At Ice Harbor Dam, redd surveys have been performed in multiple years (Table 4), with only 1 redd found downriver of the powerhouse near the outfall pipe in 1996 and 2 redds found in 2007 390 feet downstream of the bypass pipe in 22-23 feet of water (Mueller and Coleman 2008; Mueller 2009).

The low velocity and relatively fine substrate along a high percentage of the reservoir shorelines of the Lower Snake River reservoirs preclude spawning in these areas. The limited spawning that does occur is in the tailrace areas below all of the lower Snake River dams, where water velocity is high and substrate size is relatively large (Mueller and Coleman 2007, 2008). No redds have been located in other regions of the reservoirs, including shoreline areas that could be potentially affected by site development. As shown in Figure 13, although a large percentage of the areas examined downstream of Ice Harbor dam for potential fall Chinook spawning habitat contains suitable substrate, low water velocities are likely a key variable precluding suitable spawning conditions and therefore result in low quality spawning habitat (Mueller and Coleman 2007).

Since there is potential to encounter fall Chinook redds during the proposed action at Ice Harbor, Fall Chinook redd surveys will be conducted below Ice Harbor Dam in November and December 2013, prior to the proposed dredging action.

Table 4 Fall Chinook redd counts from deepwater video surveys conducted in the tailrace sections of lower Snake River dams, 1993–2008 (Mueller 2009).

	Lower Snake River Dam			
Survey Year	Lower Granite	Little Goose	Lower Monumental	Ice Harbor
1993	14	4	0	0
1994	5	4	0	0
1995	0	4	n/s[(a)]	n/s
1996	0	1	0	1
1997	0	n/s	n/s	n/s
1998	n/s	n/s	n/s	n/s
1999	n/s	n/s	n/s	n/s
2000	n/s	n/s	n/s	n/s
2001	n/s	n/s	n/s	n/s
2002	0[(b)]	n/s	0[(b)]	n/s
2003	n/s	n/s	n/s	n/s
2004	1[(b)]	n/s	0[(b)]	n/s
2005	0[(b)]	n/s	0[(b)]	n/s
2006	1	2	0	0
2007	4	0	0	2
2008	8	0	7	0

(a) No survey.
(b) Partial survey.

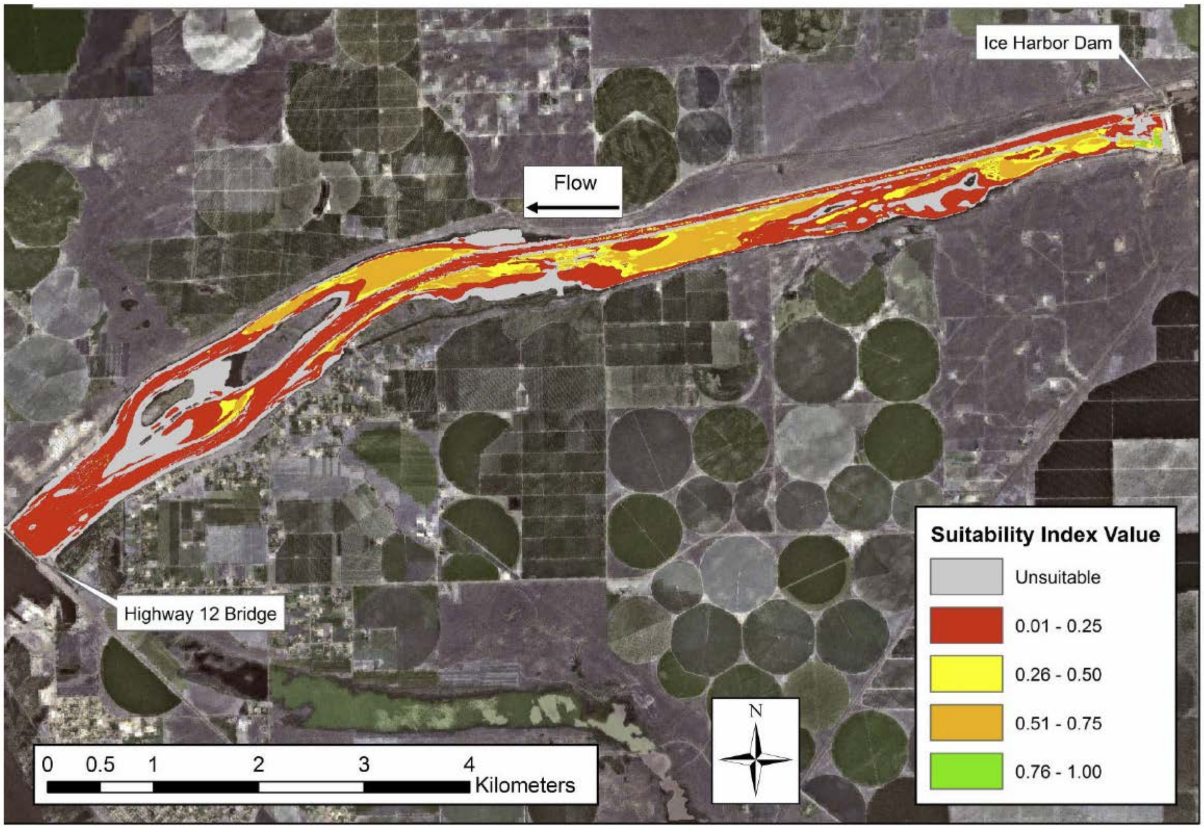

Figure 13 Fall Chinook Salmon Spawning Habitat Suitability Downstream from Ice Harbor Dam. Habitat suitability assessment is based on a 50% exceedence discharge (21.7 kcfs) during a normal water year, with the McNary Dam forebay at normal pool elevation. Suitability index values indicate a range of potential habitat from unsuitable (0.0) to high quality (1.0). (Mueller 2009).

4.4.2.5.2. Ongoing Monitoring

Passage of adult and juvenile Chinook salmon is monitored at the Snake River dams. There are also several other monitoring programs by other Federal, state and tribal organizations throughout the watershed. Fish numbers are posted on the fish passage center's website (FPC 2012). The past three years (2009 - 2011) saw significantly higher numbers of fall Chinook since prior to 1975. Use of shallow water habitat by juvenile fall Chinook has been ongoing for several years as part assessing placement of dredge materials for creation of shallow water habitat (Gottfried et al. 2011, Artzen et al 2012; Tiffan and Connor 2012). Based on recent monitoring by Tiffan and Hatten (2012) estimating subyearling fall Chinook habitat in Lower Granite Reservoir, suggests that deposition of dredge spoils at RM 116 will increase the amount of available rearing habitat in the lower Snake River. As part of the proposed action, monitoring will continue in the future to assess whether juvenile fall Chinook utilize the disposal site as expected.

4.4.3. Snake River Sockeye

4.4.3.1. Listing History

NMFS listed Snake River sockeye salmon as endangered on April 22, 1992 (57 FR 14653) and their endangered status was reaffirmed on June 28, 2005 (70 FR 37160). The Snake River sockeye salmon species includes all anadromous and residual sockeye salmon from the Snake River basin, Idaho, as well as artificially propagated sockeye salmon from the Redfish Lake captive brood stock program (NMFS 2005a).

4.4.3.2. Life History/Biological Requirements

Overall age of maturity in sockeye salmon ranges from 3 to 8 years. Male sockeye salmon are capable of maturing at any of 22 different combinations of freshwater and ocean ages, while female sockeye salmon may mature at any of 14 different age compositions (Healey 1986, 1987). For a given fish size, female sockeye salmon have the highest fecundity and the smallest egg size among the Pacific salmon (Burgner 1991). Average fecundity across the range of sockeye salmon is from 2,000 to 5,200 (Burgner 1991, Manzer and Miki 1985). Emerging fry possess heritable rheotactic and directional responses that allow fry from outlet tributaries to move upstream and fry from inlet tributaries to move downstream, in order to reach the nursery lake habitat (Raleigh 1967, Brannon 1972, Burgner 1991). Adult body size may also be affected by variations in stock abundance. Based on fishery catch data, which tends to select for larger fish than are present in the total run, Columbia River sockeye salmon average about 1.58 kg (3.5 lb) after two winters at sea (Gustafson et al. 1997).

4.4.3.3. Distribution

Anadromous sockeye were once abundant in a variety of lakes throughout the Snake River Basin, including Alturas, Pettit, Redfish, Stanley, and Yellowbelly Lakes in the Sawtooth Valley; as well as Wallowa, Payette, and Warm Lakes. However, the only remaining population resides in Redfish Lake.

Federally-listed Snake River sockeye salmon are known to occur in the project area. The lower Snake River corridor is designated as critical habitat for migration of wild SR sockeye salmon. Critical habitat for rearing or overwintering for Snake River sockeye salmon is not present in the lower Snake River corridor. The components of the migration corridor and run timing of designated critical habitat for juvenile and adult migration passage are present between mid-March and mid-June. No spawning habitat for sockeye salmon is present in the project area.

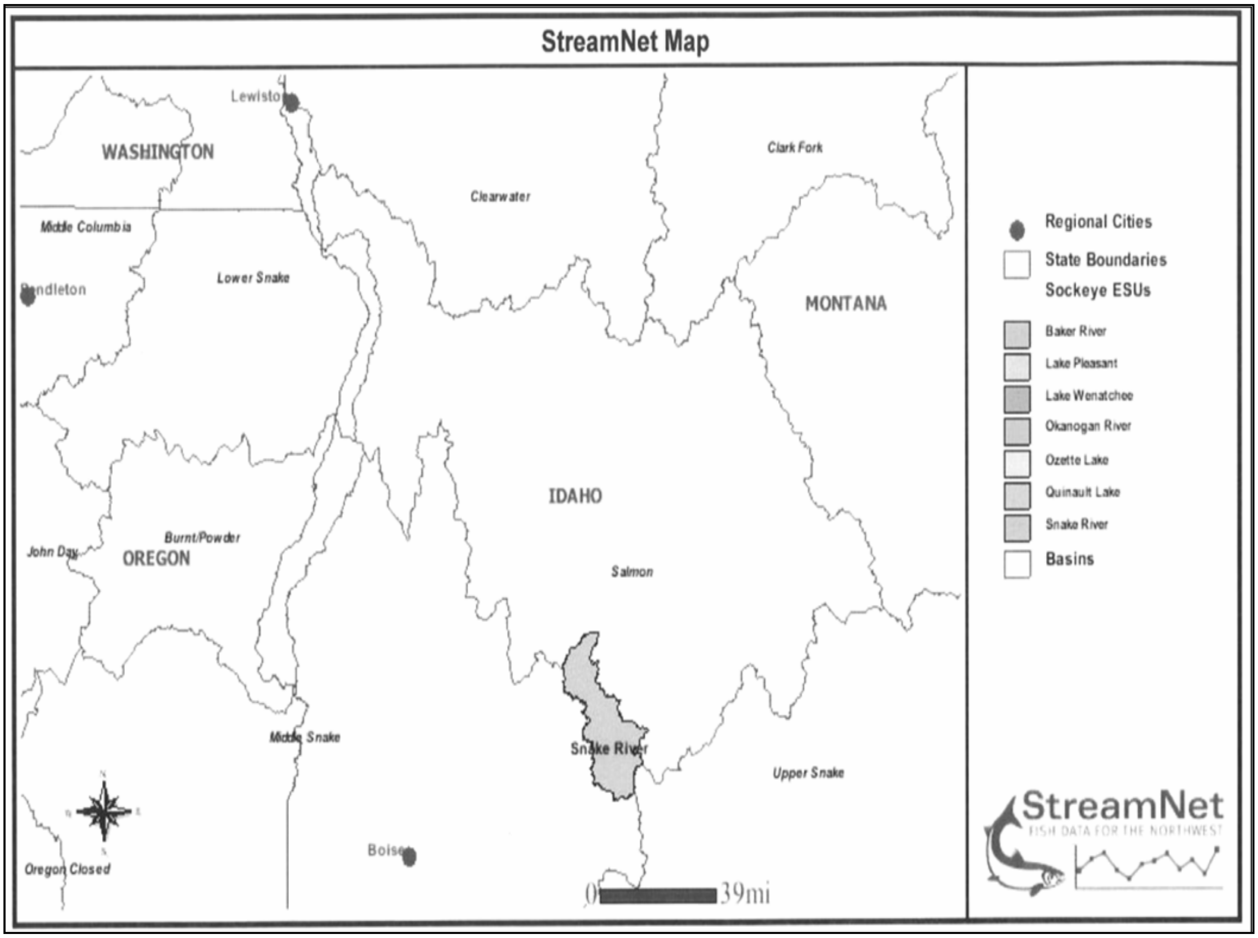

Figure 14 Snake River sockeye distribution.

4.4.3.4. Factors for Decline

4.4.3.4.1. Historical Pressures on the Species

Snake River sockeye salmon have been impacted by a wide range of factors in the past. At one time, Snake River sockeye salmon were subject to eradication programs as a means to replace them with a more desirable rainbow trout fishery. Construction of dams, roads, railroads and levees/shoreline protection, as well as irrigation withdrawals has altered the migratory habitat of juveniles and adults. Increased predation on juvenile salmonids due to the habitat changes is also a contributor to the declining salmonid population.

4.4.3.4.2. Current Pressures on the Species

Current pressures on Snake River sockeye include partial passage barriers, degraded habitat and a very low population.

4.4.3.4.3. Limiting Factors for Recovery

Though there have been increases in the past few years, the extremely low population and limited amount of suitable habitat combine to limit the potential for recovery of Snake River sockeye salmon.

4.4.3.5. Local Empirical Information

Snake River sockeye adults and juveniles can be found in the Columbia, Snake and Salmon Rivers. Adult and juvenile wild Snake River sockeye salmon are not expected to be present in the mainstem Snake or Clearwater Rivers between mid-December and February. Wild Snake River juvenile sockeye salmon generally migrate downriver during April and May, and wild adult sockeye salmon are not typically counted at Ice Harbor Dam before June or after October (Corps Annual Fish Passage Reports, 1980-2011). During sampling in May and June 2002, Bennett et al. (2003) found 21 and 14 juvenile sockeye salmon rearing along shallow-water shorelines in the Lower Granite and Little Goose reservoirs, respectively. Similarly, Artzen et al. (2012) found up to 22 juvenile sockeye at shallow water sample sites in Little Goose and Lower Granite reservoirs from April to July 2011.

4.4.3.5.1. Current Local Population Information

The Snake River sockeye salmon ESU currently consists of Redfish Lake stock in the captive broodstock program at Eagle and Beef Creek hatcheries, and the hatchery fish released from this program into Redfish Lake, Pettit Lake, Pettit Creek and Redfish Lake Creek; wild residual sockeye in Redfish Lake and their out-migrating progeny; any naturally-spawned progeny of broodstock adults released into Redfish Lake; and any adults returning to Redfish or Pettit Lake.

The population of Snake River sockeye salmon is extremely low, but has shown a substantial increase recently. Since 1962, the highest count of adults at Ice Harbor dam was 1,302 in 2010. Zero adults were counted at Ice Harbor dam in 1994 (this may be somewhat misleading since in 1994, six were counted at Lower Monumental, 44 at Little Goose and 5 at Lower Granite, all of which are located upstream from Ice Harbor). The latest 10-year average (2002-2011) is 415. The previous 10-year (1992-2001) average was 34. In 2011- 1,141 sockeye salmon were counted passing Ice Harbor Dam (FPC 2012).

4.4.3.5.2. Ongoing Monitoring

Snake River sockeye salmon are counted at the Corps' Snake River dams. Adults are counted as they move up through the ladders. Juveniles are sampled from the juvenile bypass systems and abundance estimates are made. Additional monitoring takes place in and near the lakes where sockeye spawn and rear.

4.4.4. Snake River Basin Steelhead

4.4.4.1. Listing History

Snake River Basin steelhead were listed as threatened on August 18, 1997 (62 FR 43937) and protective regulations were issued under section 4(d) of the ESA on July 10, 2000 (65 FR 42422). Their threatened status was reaffirmed on June 28, 2005 (70 FR 37160). The DPS includes all naturally spawned steelhead populations below natural and manmade impassable barriers in streams in the Snake River Basin of southeast Washington, northeast Oregon, and Idaho, as well as six artificial propagation programs: the Tucannon River, Dworshak National Fish Hatchery, Lolo Creek, North Fork Clearwater River, East Fork Salmon River, and the Little Sheep Creek/Imnaha River Hatchery steelhead hatchery programs.

4.4.4.2. Life History/Biological Requirements

The Interior Columbia Basin Technical Recovery Team (ICBTRT 2003) identified six major population groups in the DPS: (1) The Grande Ronde River system; (2) the Imnaha River drainage; (3) the Clearwater River drainage; (4) the Salmon River; (5) Hells Canyon; and (6) the lower Snake. The Snake River historically supported more than 55% of total natural-origin production of steelhead in the Columbia River Basin. It now has approximately 63% of the basin’s natural production potential.

Snake River Basin steelhead migrate a substantial distance from the ocean (up to 940 miles) and use high elevation tributaries (up to 6,562 feet above sea level) for spawning and juvenile rearing. SRB steelhead occupy habitat that is considerably warmer and drier (on an annual basis) than other steelhead DPSs. Managers classify up-river summer steelhead runs into two groups based primarily on ocean age and adult size upon return to the Columbia River. A-run steelhead are predominately age-1-ocean fish while B-run steelhead are larger, predominated by age-2-ocean fish. SRB steelhead are generally classified as summer run, based on their adult run timing pattern. SRB steelhead enter fresh water from June to October and, after holding over the winter, spawn during the following spring from March to May. Steelhead usually smolt as 2- or 3-year-olds. Outmigration occurs during the spring and early summer periods, coinciding with snowmelt in the upper drainages. Median and 90% passage dates at Lower Granite Dam for PIT tagged groups from the Imnaha River were: wild steelhead trout - May 2 and May 9; and hatchery steelhead trout - May 31 and June 16. Hatchery steelhead trout displayed small peaks in arrival timing at Lower Granite and Little Goose Dams in mid-May to mid-June; however, the general trend at each dam was a long protracted emigration (Blenden et al. 1996).

Steelhead adult migration preferred temperatures are between approximately 4°C and 9°C (39-48^{o}F) (Bell 1990). Steelhead preferred temperatures fall between 10 °C and 13°C (50-55.5^{o}F), while the upper lethal limit for steelhead is 23.9 °C (75^{o}F) (Spence et al. 1996).

With one exception (the Tucannon River production area), the tributary habitat used by Snake River steelhead DPS is above Lower Granite Dam. Annual return estimates are limited to counts of the aggregate return over Lower Granite Dam. Returns to Lower Granite Dam fluctuated widely in the 1980s and remained at relatively low levels through the 1990s. The 2001 run size at Lower Granite Dam was substantially higher relative to the 1990s. The 2002 through 2005 return years declined annually but continued to remain higher than the 1990s return years. Counts of wild steelhead passing over Lower Granite Dam, which began in 1994, show a marked increase in 2001, then a decreasing trend through 2006, followed by a small increase since that time reaching a peak of 76,161 in 2009 (FPC 2012).

4.4.4.3. Distribution

The SRB steelhead DPS is distributed throughout the Snake River drainage system, including tributaries in southwest Washington, eastern Oregon and north/central Idaho (Good et al. 2005). SRB steelhead no longer occur above Dworshak Dam. The ICBTRT (2007) identified 26 populations in the following six major population groups (MPGs) for this species: Clearwater River, Grande Ronde River, Hells Canyon, Imnaha River, Lower Snake River, and Salmon River. The North Fork population in the Clearwater River is extirpated. The ICBTRT noted that SRB steelhead remain spatially well distributed in each of the six major geographic areas in the basin (Good et al. 2005). Environmental conditions are generally drier and warmer in these areas than in areas occupied by other steelhead species in the Pacific Northwest. SRB steelhead were blocked from portions of the upper Snake River beginning in the late 1800s and culminating with the construction of Hells Canyon Dam in the 1960s.

A-run populations are found in the tributaries to the lower Clearwater River, the upper Salmon River and its tributaries, the lower Salmon River and its tributaries, the Grand Ronde River, Imnaha River, and possibly the Snake River’s mainstem tributaries below Hells Canyon Dam. B-run steelhead occupy four major subbasins, including two on the Clearwater River (Lochsa and Selway) and two on the Salmon River (Middle Fork and South Fork Salmon); areas that are for the most part not occupied by A-run steelhead. Some natural B-run steelhead are also produced in parts of the mainstem Clearwater and its major tributaries.

SRB steelhead are not known to spawn in the impounded reaches of the Snake River, but it is possible that some juveniles overwinter or rear there for short periods. Adult steelhead hold in the mainstem Snake and Columbia Rivers for extended periods (months) prior to spawning and some are likely to be in the action area during the proposed work window (Bjornn et al. 2000).

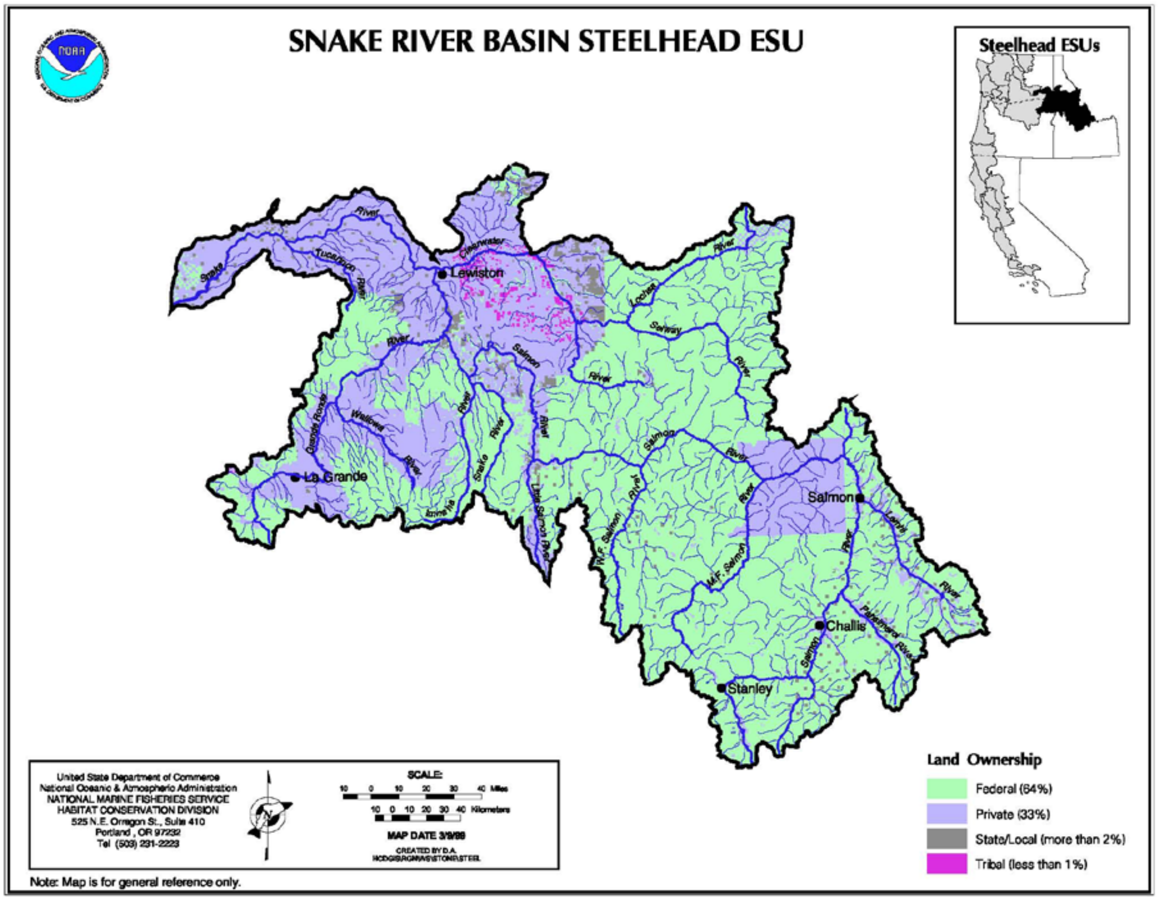

Figure 15 Snake River Basin Steelhead Distribution.

4.4.4.4. Factors for Decline

4.4.4.4.1. Historical Pressures on the Species

Historic fishing pressure began the decline of salmonid populations over 100 years ago. Construction of dams, roads, railroads, and levees/shoreline protection, as well as irrigation withdrawals has altered the rearing habitat of juvenile salmonids and the migratory habitat of juveniles and adults. Increased predation on juvenile salmonids due to the habitat changes is also a contributor to the declining salmonid population. Prior to the construction of the mainstem dams, a large percentage of the shoreline consisted of shallow water with a small particle size substrate. Today, much of the shoreline consists of deeper water bordered by riprap. This change in habitat type is likely a factor in the decline of the Columbia Basin salmonid populations.

4.4.4.4.2. Current Pressures on the Species

Hydrosystem projects create substantial habitat blockages in this ESU; the major ones are the Hells Canyon Dam complex (mainstem Snake River) and Dworshak Dam (North Fork

Clearwater River). Minor blockages are common throughout the region. Habitat in the SRB is warmer and drier and often more eroded than elsewhere in the Columbia River Basin or in coastal areas.

4.4.4.4.3. Limiting Factors for Recovery

The reduced amount of suitable habitat may be the main factor limiting steelhead recovery.

4.4.4.5. Local Empirical Information

Very little information is documented on nearshore habitat use by juvenile steelhead in the mainstem Columbia and Snake Rivers. Juvenile steelhead are thought to utilize the deeper, higher velocity areas away from the shoreline to migrate. They could potentially use the shoreline area during winter and spring for rearing.

4.4.4.5.1. Current Local Population Information

Most wild adult steelhead typically migrate through the reach between June and August for the A-run and between late August and November for the B-run. Adults from this stock may be migrating in deeper water or individuals may be holding in mid-channel areas prior to moving upriver into tributaries for spawning in early spring. Adult wild steelhead numbers passing over Ice Harbor Dam have generally increased over the last 15 years. The latest 10 year average is 45,812. The previous 7 year average (data isn't available for a 10 year average) was 19,066 (FPC 2012).

Wild juvenile SRB steelhead generally migrate downstream through the lower Snake River, mainly between late March and the end of August. Some rearing or overwintering may occur in the reservoirs.

4.4.4.5.2. Ongoing Monitoring

Passage of adult and juvenile steelhead is monitored at the Snake River dams. There are also several other monitoring programs by other Federal, state and tribal organizations throughout the watershed.

4.4.5. Bull Trout

4.4.5.1. Listing History

The USFWS issued a final rule listing the Columbia River population of bull trout as a threatened species on June 10, 1998 (63 FR 31647). Bull trout are currently listed throughout their range in the coterminous United States as a threatened species. Bull trout critical habitat was designated in September 2005. The designation was revised in October 2010. The revised designation includes the mainstem Columbia and Snake Rivers.

4.4.5.2. Life History/Biological Requirements

Individual bull trout may exhibit resident or migratory life history strategies. Resident bull trout carry out their entire life cycle in the stream in which they spawn and rear. Migratory bull trout spawn in tributary streams, but eventually travel to larger streams (or lakes) where they mature. Habitat components that appear to influence bull trout distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrates and migratory corridors (with resting habitat). All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders and deep pools.

Bull trout normally reach maturity in four to seven years and may live as long as twelve years. They generally spawn from August to November during periods of decreasing water temperatures. Migratory bull trout may travel over one hundred miles to their spawning grounds. Egg incubation is normally 100 to 145 days and fry remain in the substrate for several months.

Bull trout are opportunistic feeders. Their diet requirements vary depending on their size and life history strategy. Resident and juvenile bull trout prey on insects, zooplankton and small fish. Adult migratory bull trout mainly eat other fish.

4.4.5.3. Distribution

In the Columbia River Basin, bull trout historically were found in about 60% of the basin. They now occur in less than half of their historic range. Populations remain in portions of Oregon, Washington, Idaho, Montana, and Nevada. Bull trout are distributed throughout most of the large rivers and associated tributary systems within the Columbia River Recovery Unit. Wydoski and Whitney (2003) indicate that all four life history types of bull trout (anadromous, adfluvial, fluvial, and resident) require water temperatures below 15°C (59° F). They also note bull trout are occasionally collected in the tailraces of Priest Rapids and Wanapum Dams on the mainstem Columbia River. In Idaho, bull trout were found at elevations from 2,000 to 3,800 feet in elevation with gradients ranging from 1.9 to 8.3% (Wydoski and Whitney 2003).

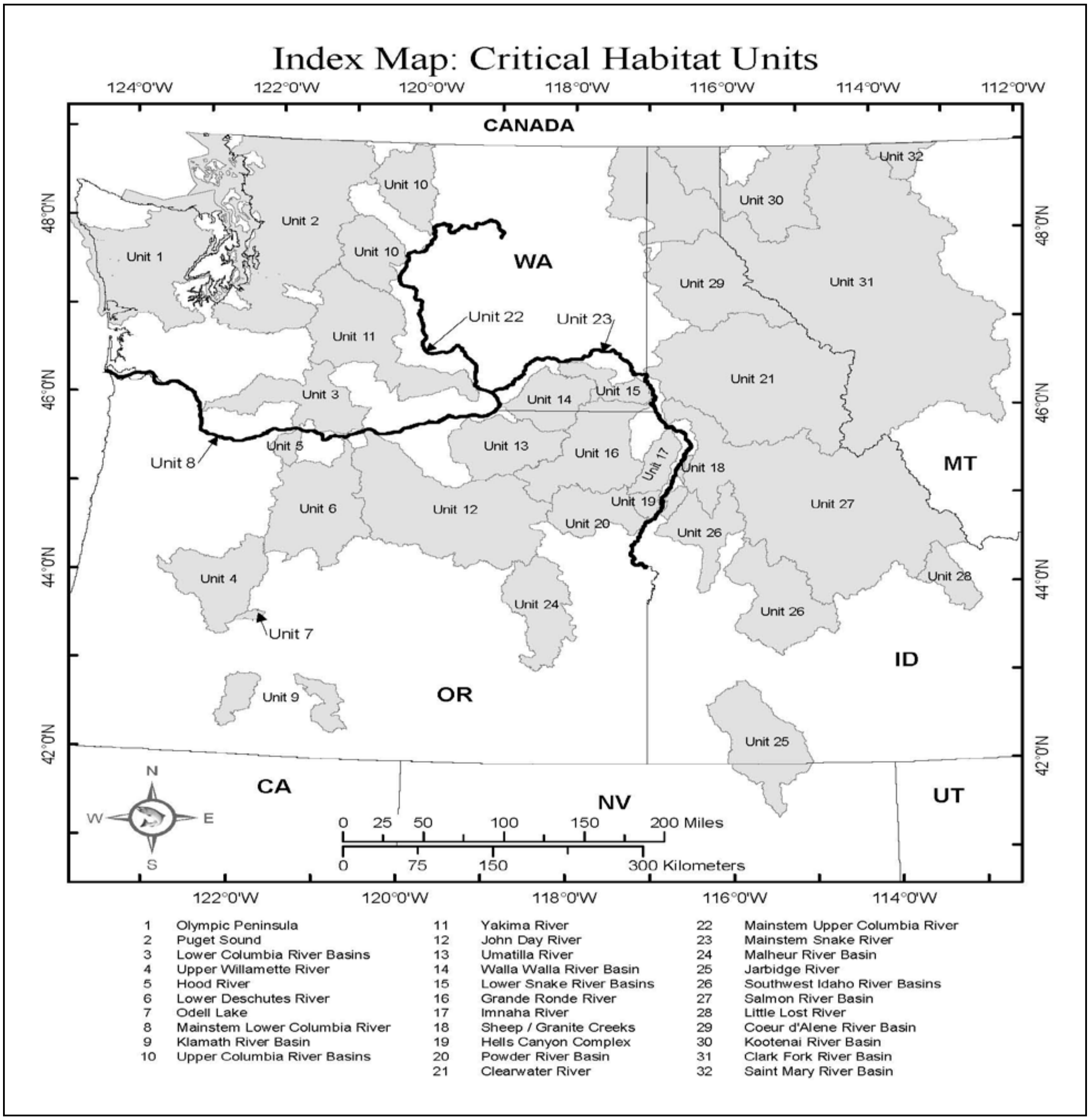

Figure 16 Bull trout approximate distribution in the Columbia Basin.

Fish passage at all of the Corps dams is monitored. Any bull trout observations are recorded, though only a few, if any, are generally seen in any year. Most of the bull trout observed are seen passing Lower Monumental and Little Goose Dams. Fish counting at the dams is not conducted during winter when bull trout are typically most apt to be in the larger rivers. For example tables 5, 6 and 7 show adult bull trout observations in 2009 at the Columbia and Snake River Corps dams.

Table 5 Adult bull trout observed at Lower Monumental in 2009.

Lower Monumental				
Date	**Time**	**Length**	**C or NC**	**Condition**
12-May-09	13.25	12		
22-May-09	1440	12	unclipped	
22-May-09	1610	10	unclipped	
3-Jun-09	1320	12 - 14	clipped	
3-Jun-09	1335	12	clipped	
4-Jun-09	803	12-13"	unclipped	small but good looking -North shore ladder
20-Jun-09	913	10	unclipped	small-North shore ladder
22-Jun-09	844	12	unclipped	north shore

Table 6 Adult bull trout observed at Little Goose in 2009.

Little Goose				
Date	**Time**	**Length**	**C or NC**	**Condition**
24-Apr-09	1808	12	unclip	good upstream
25-Apr-09	1414	12	unclip	good upstream
28-Apr-09	1340	12	unclip	good upstream
29-Apr-09	1633	15	unclip	good upstream
9-May-09	pm	15		
19-May-09	1910	13	unclip	good upstream "w" shaped body
25-May-09	1223	8	unclip	good
25-May-09	1045	15	unclip	good
27-May-09	948	13	unclip	good
8-Jun-09	430	18-20	unclip	good
11-Jun-09	1648	13	unclip	good
14-Jun-09	801	13	nonclipped	good
14-Jun-09	1908	14	nonclipped	good
15-Jun-09	921	13	unclip	good
15-Jun-09	944	15	unclip	good
15-Jun-09	953	8	unclip	good
16-Jun-09	903	12	unclip	good
17-Jun-09	811	14	unclip	good
20-Jun-09	1929	14	unclip	good
23-Jun-09	1421	14	unclip	good
24-Jun-09	1748	10	unclip	good
24-Jun-09	1831	14	unclip	good
25-Jun-09	925	12	unclip	good
25-Jun-09	1415	14	unclip	good
26-Jun-09	930	14	unclip	good
27-Jun-09	740	12	unclip	good
29-Jun-09	735	15	unclip	good
1-Jul-09	840	15	unclip	good
2-Jul-09	712	12	unclip	good
2-Jul-09	945	14	unclip	
4-Jul-09	705	18	unclip	good
7-Jul-09	1414	12	unclip	good
8-Jul-09	1241	14	unclip	good

Table 7 Adult bull trout observed at Lower Granite in 2009.

Lower Granite				
Date	**Time**	**Length**	**C or NC**	**Condition**
30-May-09	1203	14	non clipped	good
19-Jun-09	1434	12	non clipped	good
28-Jun-09	521	12	non clipped	good
30-Jun-09	1822	12	non clipped	good
6-Jul-09	1151	10	non clipped	good
8-Jul-09	1310	15	non clipped	good

Anglin et al. (2010) estimated a total of 192 bull trout emigrated from the Walla Walla Basin to the Columbia River from November 2007 through December 2009. They estimated that 36 PIT tagged bull trout entered the Columbia from the Walla Walla in 2009. However, over the duration of their 2009 study, only one bull trout was detected, in June, returning to the Walla Walla River from the Columbia River. Four Walla Walla Basin bull trout were detected at mainstem Columbia River dams over the duration of the study. Detections at the juvenile facilities at John Day and McNary dams indicated two of these bull trout were moving downstream. Detections in the adult ladders at McNary and Priest Rapids dams indicated two of these bull trout were moving upstream (Anglin et al. 2010). Two additional bull trout were detected returning to the Walla Walla from the Columbia River in mid-April 2010.

Anglin et al. (2010) also indicate bull trout dispersed into the mainstem Columbia River from the Walla Walla Basin, and at times, this dispersal included a relatively long migration. One bull trout moved 130 river kilometers (rkm) upstream and was detected at Priest Rapids Dam, and another moved 162 rkm downstream to John Day Dam (Anglin et al. 2010).

The timing of migratory bull trout movement from the Walla Walla River to the Columbia River varies from year to year, but generally occurs between October and May, peaking between December and February (Anglin et al. 2010). Adult bull trout migrating from the Columbia River might initiate upstream movement in April (R. Koch, personal communication, August 30, 2010).

Faler et al. (2008) report that bull trout in the Tucannon River, upstream of Lower Monumental Dam, migrated upstream in spring and early summer to the spawning areas in upper portions of the Tucannon River watershed. The fish in their study quickly moved off the spawning areas in the fall, and either held or continued a slower migration downstream until March or April. By June 1, most bull trout had ascended the Tucannon River. During late fall and winter, bull trout were distributed in the lower half of the Tucannon River basin, down to and including the mainstem Snake River below Little Goose Dam.

They observed bull trout migrations into the Lower Monumental reservoir area influenced by the lower Tucannon River and/or the Snake River for 6 individuals. Two of the fish never returned to the Tucannon River. One individual made multiple movements to and from the reservoir near the mouth of the Tucannon, but it spent much of the winter within the reservoir influence area of the Tucannon River (Faler 2008).

Two Tucannon PIT tags have also been detected outside of the reservoir. One by NMFS personnel conducting Avian Predation Study efforts on a Columbia River island in 2002, and the other in the Catherine Creek (tributary to the Grande Ronde River) acclimation pond in 2003 (Faler 2008).

Based on the Anglin et al. studies (ongoing), and the Faler et al. studies, it is clear that some individual bull trout migrate out of their natal streams and into the mainstem Columbia and Snake Rivers. Clearly actual abundance and amount of usage by bull trout during migration and overwintering is not yet known in reservoirs behind Corps operated dams, but given the evidence, the number of migratory bull trout using the action area is extremely low relative to other salmonids.

There have been several observations of adult bull trout passing Lower Monumental and Little Goose dams. From 1994 to 1996, 27 bull trout passed the adult fish counting station (mainly in April and May) at Little Goose. At least six bull trout passed counters at Lower Monumental and Little Goose in 1990 and 1992 (Kleist 1993). Kleist also observed one bull trout in 1993 just downstream of the count window at Lower Monumental. One bull trout was captured in the Palouse River below Palouse Falls in 1998. These were likely migratory fish from the Tucannon River; however, one bull trout was observed at Lower Granite in 1998 that may indicate fluvial fish are migrating to other upstream populations. Incidental collection of bull trout at lower Snake River dams in juvenile bypass facilities, observations of bull trout within adult fish ladders (Battelle 2004, Bretz 2011), and radio telemetry and PIT tag studies (Faler et al. 2003, 2004, 2005, 2006, 2007; Bretz 2008, 2009) have shown that migratory adults from the Tucannon River utilize the mainstem Snake River as overwintering habitat and as a migratory corridor (Bretz 2011; DeHaan and Bretz 2012). Although bull trout have been observed at these dams, the extent to which Federal Columbia River Power System (FCRPS) operations alter the migratory patterns of bull trout or impede passage and the origins of the fish observed at the Snake River dams are relatively unknown. The results of DeHaan and Bretz (2012) suggest that migratory bull trout originating from the tributaries such as the Tucannon and Imnaha Rivers are utilizing the fish facilities at Little Goose Dam).

During recent sampling of shallow water habitats in the Lower Snake River Reservoirs, single bull trout have been collected some years at a sampling site in the Lower Tucannon River (Seybold and Bennett 2010, Artzen et al. 2012). Researchers speculated this sampling was probably not indicative of widespread bull trout use of the Lower Snake River Reservoirs; instead, it is potentially indicative of an adfluvial life history strategy (Seybold and Bennett 2010). During sampling and tracking of bull trout in the lower Tucannon River between the fall of 2005 and spring of 2009, Bretz (2010) estimated a minimum proportion of 6-29% of PIT-tagged bull trout migrated between the Tucannon River and the mainstem Snake River within a single migratory year. Evaluation of PIT-tag passage data in the Tucannon River by Bretz (2010) indicates bull trout are in the reservoir influence zone during October, November and December with juvenile and adult outmigrating occurring between October and February; which supports the time frame of outmigration established by Faler et al. (2008) who observed the distribution of bull trout in the lower Tucannon River and the mainstem Snake River during the late fall and winter months. The detections within the months of March through June are adults returning to the Tucannon River to spawn. A single bull trout was detected leaving the Tucannon River in May 2010 and subsequently detected at Little Goose Dam, both in the Full Flow Bypass and the Adult Fish Return (Bretz 2011).

4.4.5.4. Factors for Decline

4.4.5.4.1. Historical Pressures on the Species

Bull trout are estimated to have occupied about 60 percent of the Columbia Basin and presently occur in only about 45 percent of their historic range. The decline of bull trout is primarily due to habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices and the introduction of non-native species. Declining salmon and steelhead populations could also negatively impact bull trout populations by reducing the number of juvenile salmon and steelhead that bull trout might prey on.

4.4.5.4.2. Current Pressures on the Species

Bull trout habitat is sensitive to stream channel changes. Altered flow regimes, sedimentation rates, bank erosion and reduced channel complexity all reduce the quality of bull trout habitat.

4.4.5.4.3. Limiting Factors for Recovery

Barriers between isolated populations are a limiting factor for most of the bull trout subpopulations in the Columbia Basin.

4.4.5.5. Local Empirical Information

4.4.5.5.1. Current Local Population Information

The few remaining bull trout strongholds in the Columbia River basin tend to be found in large areas of contiguous habitats in the Snake River basin of the central Idaho mountains, upper Clark Fork and Flathead Rivers in Montana, and several streams in the Blue Mountains in Washington and Oregon. Populations also exist in the Yakima River watershed. Very little is known about the number of bull trout within the mainstem, lower Snake River. The number is presumed to be very low. Table 8 shows the number of bull trout seen at various dams in the past few years.

Table 8 Bull trout fish ladder counts for Corps dams in Snake and Columbia rivers in the action area.

Ladder	Totals (number of individuals)			
	2011	2010	2009	2008
McNary Oregon shore fish ladder at McNary Dam	0	0	0	0
McNary Washington shore fish ladder at McNary Dam	0	0	0	0
Ice Harbor South fish ladder at Ice Harbor Dam	3	0	0	0
Ice Harbor North fish ladder at Ice Harbor Dam	0	0	0	0
Lower Monumental South fish ladder at Lower Monumental Dam	0	0	0	0
Lower Monumental North fish ladder at Lower Monumental Dam	47	12	5	2
Little Goose Dam (one fish ladder)	161	73	37	27
Lower Granite Dam (one fish ladder)	1	8	6	8

4.4.5.5.2. Ongoing Monitoring

Fish passage, including bull trout, at the lower Snake River dams is monitored. Any bull trout observations are recorded, though only a few, if any, are generally seen in any year. However, fish counting does not occur during winter when bull trout are most likely to be present. The USFWS operates a PIT tag detector on the lower Walla Walla River which has detected some bull trout leaving and returning to the Walla Walla River. They also operate a smolt trap on the Walla Walla River in conjunction with the Confederated Tribes of the Umatilla Indian Reservation.

4.4.6. Pygmy Rabbit

4.4.6.1. Listing History

The Columbia Basin pygmy rabbit DPS was listed as an endangered species by USFWS under an emergency regulation in 2001. The species was confirmed listed as endangered in 2003, without designation of critical habitat. The recovery priority number for the Columbia Basin pygmy rabbit is 3, on a scale from 1C (highest) to 18 (lowest). The Washington Department of Fish and Wildlife began a captive breeding program for the Columbia Basin pygmy rabbit in 2001. The Columbia Basin pygmy rabbit was considered to be extirpated from the wild in mid-2004. On March 13, 2007, 20 captive-bred animals were reintroduced to habitats historically occupied by the species in the Columbia Basin of central Washington. These captive-bred animals experienced a high level of predation over the first several weeks following their release, and as of May 15, 2007, five of them remained alive. Just prior to the release effort there were 86 individuals included in a captive breeding program, 3 of which were purebred Columbia Basin animals. At least one wild-born, and likely captive-bred kit (approximately 1-month old), has been documented at the release site. The remaining captive-bred female was also seen displaying nesting behavior. The balance of the captive population and those recently released to the wild consist of intercross progeny from controlled matings between Columbia Basin pygmy rabbits and pygmy rabbits of the same taxonomic classification from a discrete population in Idaho. Intercross breeding has helped facilitate genetic restoration of the Columbia Basin pygmy rabbit and is considered essential for recovery efforts. Currently, proposed measures to recover the Columbia Basin pygmy rabbit in the wild include additional releases of captive-bred progeny with at least 75 percent Columbia Basin ancestry (USFWS 2007).

4.4.6.2. Life History/Biological Requirements

Pygmy rabbits occur in the semiarid shrub steppe biome of the Great Basin and adjacent intermountain regions of the western United States. Within this broad biome, pygmy rabbits are typically found in habitat types that include tall, dense stands of sagebrush (*Artemesia* spp.), upon which they are highly dependent on for food and shelter throughout the year. The pygmy rabbit is one of only two rabbit species in North America that digs its own burrows and, therefore, is most often found in areas that also include relatively deep, loose soils that allow burrowing (USFWS 2007).

4.4.6.3. Distribution

There are no known pygmy rabbit populations along the lower Snake River. The historic and current Washington distribution can be seen in Figure 17. Pygmy rabbit's historic range may have included northern Benton and Franklin Counties, Washington, but they are no longer found there. Currently, pygmy rabbits are known to survive in five isolated fragments of suitable habitat in Douglas County. The pygmy rabbit historical range includes portions of the following states: California, Oregon, Nevada, Idaho, Montana, Wyoming, Utah, and Washington.

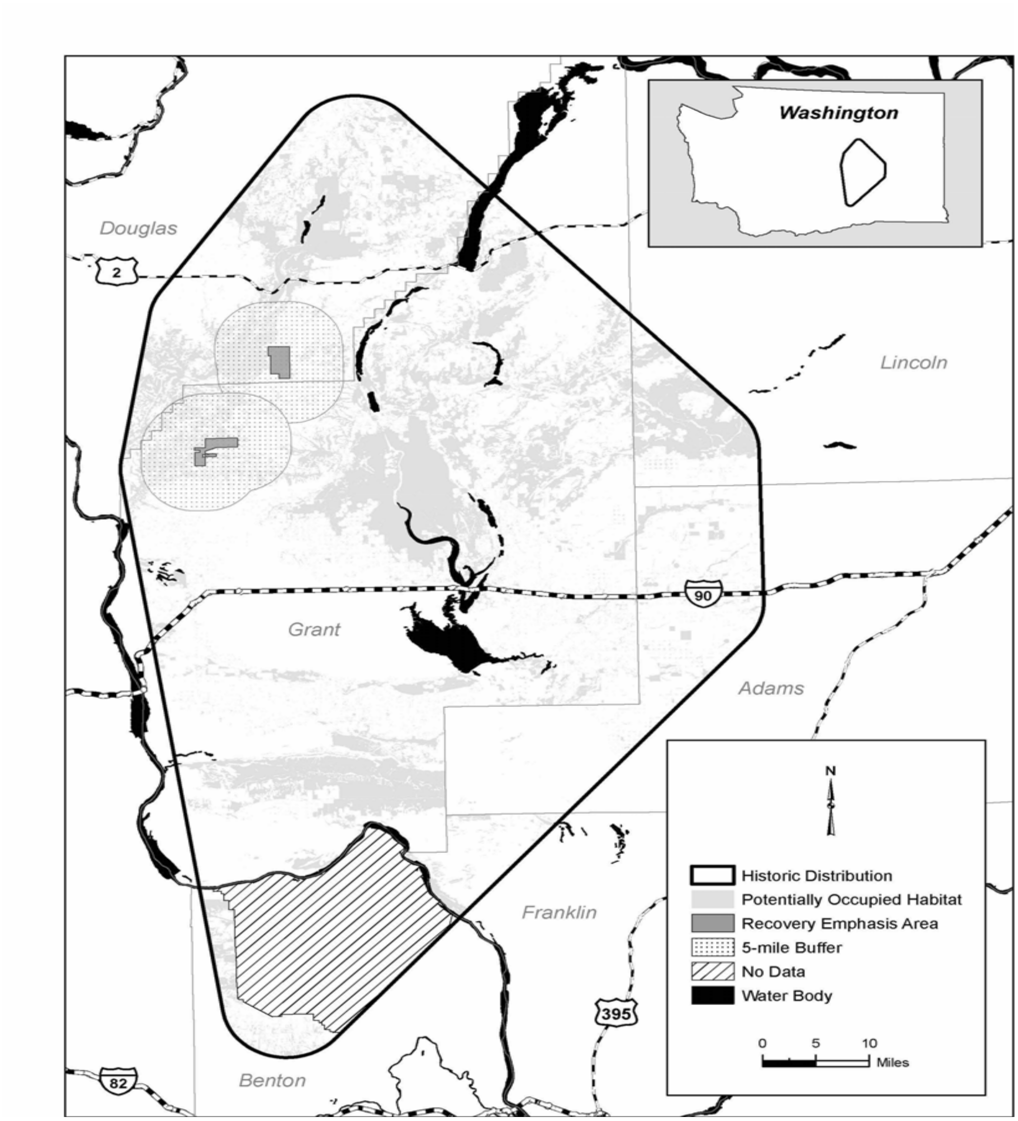

Figure 17 Historic distribution of the Columbia Basin pygmy rabbit, potentially occupied habitat, and recovery emphasis areas with 5-mile buffers.

4.4.6.4. Factors for Decline

4.4.6.4.1. Historical Pressures on the Species

The loss of shrub-steppe habitat to agricultural and other development has been a major factor affecting the continued survival of pygmy rabbits.

4.4.6.4.2. Current Pressures on the Species

There are several threats to the Columbia Basin pygmy rabbit population including disease and habituation in captivity and the potential for outbreeding depression in the wild. In addition, the present or threatened destruction, modification, or curtailment of its habitat or range reduces this species' chances of survival.

4.4.6.4.3. Limiting Factors for Recovery

The extremely low population of Columbia Basin pygmy rabbits combined with habitat loss and the effects of predators limit recovery of this species.

4.4.6.5. Local Empirical Information

Pygmy rabbits are not found near the action area or Snake River. The proposed project will have no effect on pygmy rabbits.

4.4.6.5.1. Current Local Population Information

There are no local populations of pygmy rabbits along the lower Snake River or near any lands around the proposed action.

4.4.6.5.2. Ongoing Monitoring

Researchers at Washington State University (Sayler et al. 2007), through coordination with the USFWS and the Washington Department of Fish and Wildlife, have developed a reintroduction plan that identifies specific procedures for release and monitoring of captive-bred Columbia Basin pygmy rabbits (USFWS 2007).

4.4.7. Canada Lynx

4.4.7.1. Listing History

The Canada lynx was listed as a threatened species in 2000. In 2003, in response to a court-order to reconsider the listing, USFWS clarified their final listing decision. Lynx are known to inhabit areas in Washington and Idaho, but due to a lack of data, the historic and current status of resident lynx populations in Oregon is uncertain.

4.4.7.2. Life History/Biological Requirements

Canada lynx are medium-sized cats, generally measuring 75-90 centimeters long (30-35 inches) and weighing 8-10.5 kilograms (18-23 pounds). Canada lynx are smaller than the European lynx with a shorter tail and longer hind legs. They have large feet adapted to walking on snow, long legs, tufts on the ears, and black-tipped tails. They are highly adapted for hunting snowshoe hare, the primary prey, in the snows of the boreal forest.

Lynx in the contiguous United States are at the southern margins of a widely-distributed range across Canada and Alaska. The center of the North American range is in north-central Canada. Lynx occur in mesic coniferous forests that have cold, snowy winters and provide a prey base of snowshoe hare (Ruggiero et al. 2000). These forests are generally described as boreal forests. In North America, the distribution of lynx is nearly coincident with that of snowshoe hares. Lynx survivorship, productivity, and population dynamics are closely related to snowshoe hare density in all parts of its range. A minimum density of snowshoe hares (greater than 0.5 hare per hectare (1.2 hares per acre)) distributed across a large landscape is necessary to support survival of lynx kittens and recruitment into and maintenance of a lynx population.

The southernmost extent of the boreal forest that supports lynx occurs in the contiguous United States in the Northeast, western Great Lakes, northern and southern Rockies, and northern Cascades. Here the boreal forest transitions into other vegetation communities and becomes more patchily distributed. As a result, the southern boreal forests generally support lower snowshoe hare densities, hare populations do not appear to be as highly cyclic as snowshoe hares further north, and lynx densities are lower compared to the northern boreal forest. Individual lynx maintain large home ranges (reported as generally ranging from 31 to 216 kilometers^2 (km^2), or 12-83 miles^2 (mi^2). Thus, a lynx population can only persist in a large boreal forested landscape that contains appropriate forest types, snow depths, and high snowshoe hare densities.

4.4.7.3. Distribution

Recent observations of lynx are primarily from the Cascade Range and the Blue Mountains. Canada lynx likely have never been as abundant in the lower 48 States as they were in northern Canada and Alaska because there is less lynx and snowshoe hare habitat at the southern part of the range.

In western states, most lynx occurrences (83%) were associated with Rocky Mountain Conifer Forest, and most (77%) were within the 1,500-2,000 m (4,920-6,560 ft) elevation zone (McKelvey et al. 1999). Primary vegetation that contributes to lynx habitat is lodgepole pine, subalpine fir, and Engelmann spruce (Aubry et al. 2000). In extreme northern Idaho, northeastern Washington, and northwestern Montana, cedar-hemlock habitat types may also be considered primary vegetation. In central Idaho, Douglas-fir on moist sites at higher elevations may also be considered primary vegetation. Secondary vegetation when interspersed within subalpine forests, may also contribute to lynx habitat. These vegetation types include cool, moist Douglas-fir, grand fir, western larch, and aspen forests. Dry forest types (e.g., ponderosa pine, climax lodgepole pine) do not provide lynx habitat (USACE 2006).

4.4.7.4. Factors for Decline

4.4.7.4.1. Historical Pressures on the Species

Lynx populations in the Northwest U.S. have likely never been high. However, lynx were hunted and trapped along with bobcat until just prior to their listing under the ESA. Roads, timber harvest, and human development have further reduced lynx populations.

4.4.7.4.2. Current Pressures on the Species

The same factors historically affecting lynx continue to affect lynx today, though take from hunting and trapping is likely lower than historical levels.

4.4.7.4.3. Limiting Factors for Recovery

While the lynx population in the U.S. was likely never very high, the low population size and limited amount of quality habitat in the U.S. limit the recovery of lynx populations.

4.4.7.5. Local Empirical Information

4.4.7.5.1. Current Local Population Information

There are no known local populations or individuals of Canada lynx near the action area or the lower Snake River. The proposed project will have no effect on Canada lynx.

4.4.7.5.2. Ongoing Monitoring

The Idaho Department of Fish and Game (IDFG) has used 12 remote camera stations and live traps conducted surveys for furbearers and carnivores throughout Dworshak Reservoir in 2000 and 2001. Eleven species of furbearers and carnivores were documented. No lynx were observed within the study area. However, lynx have been documented in 2 locations north of Breakfast Creek, one on the Floodwood Road in 1997 and once at Stocking Meadows Ridge in 1998 (USACE 2006).

4.4.8. Ute ladies'-tresses

4.4.8.1. Listing History

Ute ladies'-tresses was listed as threatened in 1992 in its entire range. Within the area covered by this listing, this species is known to occur in Colorado, Idaho, Montana, Nebraska, Utah, Washington, and Wyoming. In 2004, USFWS contracted for a comprehensive status review of this species. A draft of this report became available in February 2005. A final draft of the status review was completed in October 2005. USFWS has determined a petition to remove the Ute ladies'-tresses orchid from Federal protection under the ESA provides substantial biological information to indicate that removal may be warranted.

4.4.8.2.Life History/Biological Requirements

Ute-ladies'-tresses is a perennial, terrestrial orchid with 7 to 32-inch stems arising from tuberously thickened roots. The flowering stalk consists of few to many small white or ivory flowers clustered into a spiraling spike arrangement at the top of the stem. The species is characterized by whitish, stout flowers. It blooms, generally, from late July through August. The orchid occurs along riparian edges, gravel bars, old oxbows, high flow channels, and moist to wet meadows along perennial streams. It typically occurs in stable wetland and seepy areas associated with old landscape features within historical floodplains of major rivers, as well as in wetlands and seeps near freshwater lakes or springs. Ute ladies'-tresses ranges in elevation from 720 to 1,830 ft in Washington to 7,000 ft in northern Utah. Nearly all occupied sites have a high water table (usually within 5 to 18 inches) of the surface augmented by seasonal flooding, snowmelt, runoff, and irrigation.

Since 1992, at least 26 new populations of Ute ladies'-tresses have been documented from perennial stream, river, lakeshore, and spring sites directly associated with human-developed dams, levees, reservoirs, irrigation ditches, reclaimed gravel quarries, roadside barrow pits, and irrigated meadows. In all, 33 of 61 documented populations (54%) occur in sites in which natural hydrology has been influenced by dams, reservoirs, or supplemental irrigation. Even sites with undisturbed hydrology, however, have been influenced by human agricultural practices, urban development, or road and dam construction (Fertig et al. 2005).

4.4.8.3.Distribution

Distribution of Ute ladies'-tresses is shown in Figure 18. It does not appear to occur on Corps managed lands in the District.

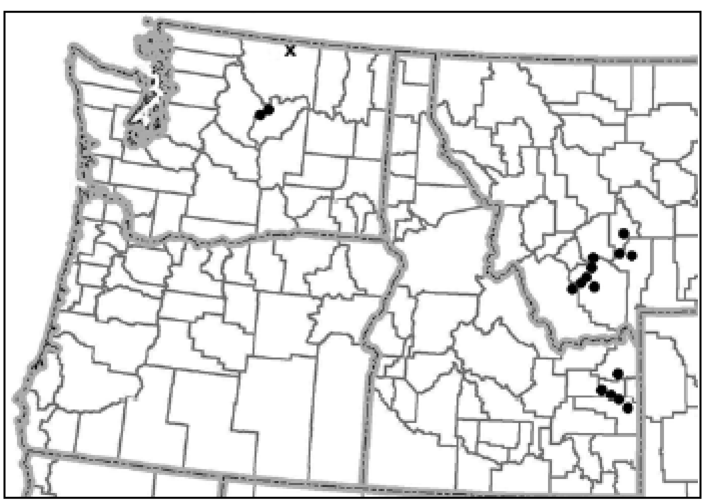

Figure 18 Known distribution of Ute-ladies'-tresses in western North America circa July 2005. Extant populations are indicated by black circles, while extirpated populations are marked by an "x". Excerpted from Fertig et al. 2005.

Idaho

Ute ladies'- tresses was first discovered in Idaho by Mabel Jones in 1996 along the South Fork of the Snake River (Moseley 1997). The species is now known from Bonneville, Fremont, Jefferson, and Madison counties along the Snake River and from wetland sites along the Henry's Fork River (Mancuso 2004, Moseley 1998a, 1998b, 1999a, Murphy 2004). Idaho populations occur in the Idaho Falls, Palisades, and Lower Henrys watersheds within the Columbia Plateau and Utah-Wyoming Rocky Mountains ecoregions (Fertig et al. 2005).

Washington

Ute ladies'-tresses was first discovered in Washington at Wannacut Lake in Okanogan County (also in the Okanogan watershed and ecoregion) in 1997 (Bjork 1997). In 2000, the species was also found along a reservoir bordering the Columbia River near Chelan in Chelan County (Chief Joseph watershed) within the Columbia Plateau ecoregion (Fertig et al. 2005).

4.4.8.4.Factors for Decline

4.4.8.4.1. Historical Pressures on the Species

The historic population size of Ute ladies'-tresses is unknown. It is likely construction of roads, levees along streams, other development and livestock grazing have decreased numbers of this plant in some areas.

4.4.8.4.2. Current Pressures on the Species

The same factors which historically affected this species continue to affect the plant today. The USFWS received a petition to delist Ute ladies'-tresses in 2004. The USFWS concluded there was substantial information to warrant a status review to determine if delisting was warranted. The outcome of the status review is unknown.

4.4.8.4.3. Limiting Factors for Recovery

Since Ute ladies'-tresses was listed it has been found in many previously unknown locations. While this does not indicate the plant has recovered, it seemingly reduces the urgency of its need for protection under the ESA.

4.4.8.5.Local Empirical Information

4.4.8.5.1. Current Local Population Information

There are no known local populations of Ute ladies'-tresses near the lower Snake River. No Ute ladies'-tresses were found in any of the HMUs on Corps lands between Lyon's Ferry (RM 59) upstream to Asotin Slough (RM 147), and upstream of the confluence of the Snake and Clearwater Rivers to RM 8.2 on the Clearwater during a 2008 vascular plant survey on Corps lands in the upper Snake River (Bailey 2008a, 2008b).

The proposed action will have no effect on Ute ladies'-tresses.

4.4.8.5.2. Ongoing Monitoring

Local monitoring on Corps lands within the action area may occur where suitable habitat is present. There is no ongoing, District-wide monitoring for Ute ladies'-tresses at this time.

4.4.9. Spalding's Catchfly

4.4.9.1.1. Listing History

Spalding's catchfly was listed as a threatened species on October 10, 2001. Spalding's catchfly is native to portions of Idaho, Montana, Oregon, Washington, and British Columbia, Canada. Fifty-eight percent of Spalding's catchfly populations occur either entirely or partially on private land; the remaining populations occur on Federal lands (U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Refuges, National Park Service, and Department of Defense), and state and tribal lands.

4.4.9.2.Life History/Biological Requirements

Spalding's catchfly is an herbaceous perennial plant in the pink family (*Caryophyllacea*). Spalding's catchfly produce one to several vegetative or flowering stems arising from a simple or branched persistent underground stem (caudex), which surmounts a long, narrow taproot. Plants range from 20 to 40 cm in height. Each stem typically bears 4 to 7 pairs of simple, opposite leaves that are 5 to 8 cm in length and 2 to 4 cm in width. Reproductive individuals produce 3 to 20 cream to pink or light green flowers borne in a branched, terminal inflorescence. All green portions of the plant (foliage, stem, and flower bracts) are covered in dense sticky hairs that frequently trap dust and arthropods, giving this species the common name 'catchfly'. Plants (both vegetative and reproductive) emerge in mid-to late May. Flowering typically occurs from mid-July through August, but may occasionally continue into October.

Rosettes are formed the first and possibly the second year, followed by the formation of vegetative stems. Above-ground vegetation dies back at the end of the growing season and plants either emerge in the spring or remain dormant below ground for one to several consecutive years. Spalding's catchfly reproduces solely by seed. Spalding's catchfly was listed as threatened in 2001 and a final recovery plan for this plant was released October 15, 2007.

4.4.9.3.Distribution

The species is endemic to the Palouse region of south-east Washington and adjacent Oregon and Idaho, and is disjunct in northwestern Montana and British Columbia, Canada. This species is found predominantly in the Pacific Northwest bunchgrass grasslands and sagebrush-steppe, and occasionally in open-canopy pine stands. Occupied habitat includes five physiographic (physical geographic) regions: 1) the Palouse Grasslands in west-central Idaho and southeastern Washington; 2) the Channeled Scablands in east-central Washington; 3) the Blue Mountain

Basins in northeastern Oregon; 4) the Canyon Grasslands along major river systems in Idaho, Oregon, and Washington; and 5) the Intermontane Valleys of northwestern Montana and British Columbia, Canada.

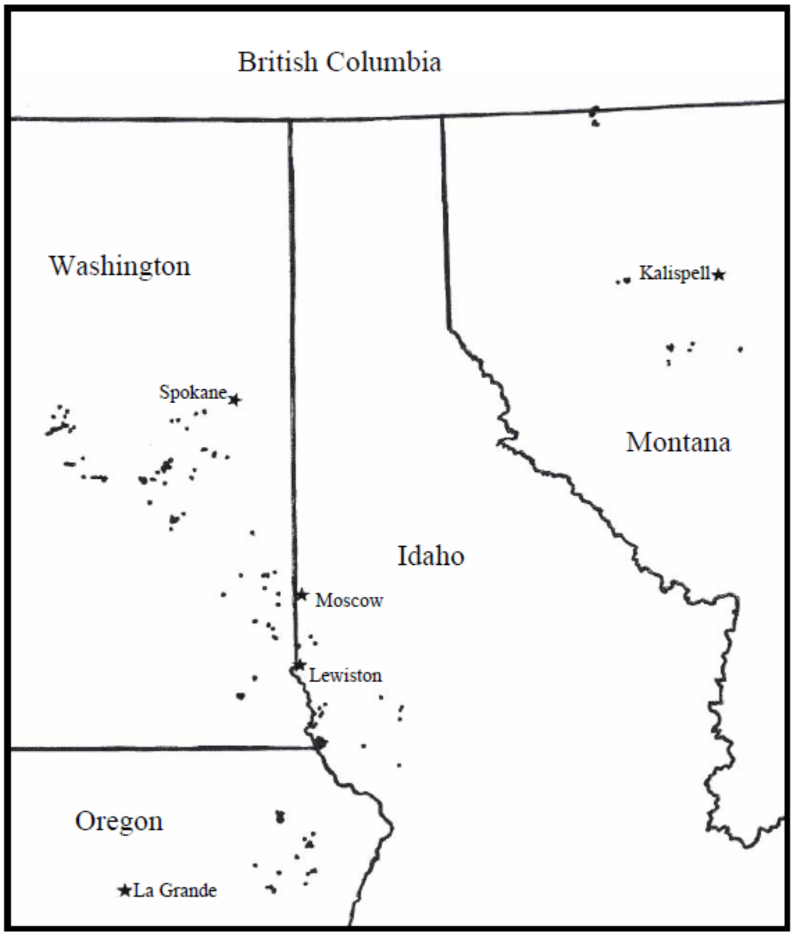

Figure 19 Rangewide distribution of Spalding's catchfly (*Silene spaldingii*) (Gray and Lichthardt 2004).

4.4.9.4.Local Empirical Information

4.4.9.4.1. Current Local Population Information

There are no known local populations of Spalding's catchfly in the action area. This species was not found in any of the HMUs on Corps lands between Lyon's Ferry (RM 59) upstream to Asotin Slough (RM 147), and upstream of the confluence of the Snake and Clearwater Rivers to RM 8.2 on the Clearwater during a 2008 vascular plant survey on Corps lands in the upper Snake River (Bailey 2008a, 2008b).

The proposed project will have no effect on Spalding's catchfly.

4.4.9.4.2. Ongoing Monitoring

Currently there is no monitoring for Spalding's catchfly on Corps lands.

4.5. Status of Critical Habitat

4.5.1. Snake River Spring/Summer Chinook

4.5.1.1. Geographical Extent of Designated Critical Habitat

NMFS designated critical habitat for SRSS Chinook to include the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) and including all Columbia River estuarine areas and river reaches proceeding upstream to the confluence of the Columbia and Snake Rivers; all Snake River reaches from the confluence of the Columbia River upstream to Hells Canyon Dam.

Critical habitat also includes river reaches presently or historically accessible (except reaches above impassable natural falls (including Napias Creek Falls) and Dworshak and Hells Canyon Dams) to SRSS Chinook salmon in the following hydrologic units: Hells Canyon, Imnaha, Lemhi, Little Salmon, Lower Grande Ronde, Lower Middle Fork Salmon, Lower Salmon, Lower Snake-Asotin, Lower Snake-Tucannon, Middle Salmon-Chamberlain, Middle Salmon-Panther, Pahsimeroi, South Fork Salmon, Upper Middle Fork Salmon, Upper Grande Ronde, Upper Salmon, Wallowa. Critical habitat borders on or passes through the following counties in Oregon: Baker, Clatsop, Columbia, Gillium, Hood River, Morrow, Multnomah, Sherman, Umatilla, Union, Wallowa, Wasco; the following counties in Washington: Asotin, Benton, Clark, Columbia, Cowlitz, Franklin, Garfield, Klickitat, Pacific, Skamania, Wahkiakum, Walla Walla, Whitman; and the following counties in Idaho: Adams, Blaine, Custer, Idaho, Lemhi, Lewis, Nez Perce, Valley.

4.5.1.2. Essential Elements of Designated Critical Habitat

Table 9 lists the PCEs for Snake River salmon.

Table 9 Primary constituent elements (PCEs) of critical habitats designated for SRSS Chinook salmon, SRF Chinook salmon, and SR sockeye salmon, and corresponding species life history events.

Primary Constituent Elements		Species Life History Event
Site	**Site Attribute**	
Spawning and juvenile rearing areas	Access (sockeye) Cover/shelter Food (juvenile rearing) Riparian vegetation Space (Chinook) Spawning gravel Water quality Water temperature (sockeye) Water quantity	Adult spawning Embryo incubation Alevin development Fry emergence Fry/parr growth and development Fry/parr smoltification Smolt growth and development
Juvenile migration corridors	Cover/shelter Food Riparian vegetation Safe passage Space Substrate Water quality Water quantity Water temperature Water velocity	Fry/parr seaward migration Smolt growth and development Smolt seaward migration
Areas for growth and development to adulthood	Ocean areas – not identified	Adult growth and development Adult sexual maturation Fry/parr smoltification Smolt/adult transition
Adult migration corridors	Cover/shelter Riparian vegetation Safe passage Space Substrate Water quality Water quantity Water temperature Water velocity	Adult sexual maturation Adult “reverse smoltification” Adult upstream migration Kelt (steelhead) seaward migration

4.5.2. Snake River Fall Chinook

4.5.2.1. Geographical Extent of Designated Critical Habitat

The proposed dredging will occur within designated critical habitat for SRF Chinook salmon. Freshwater critical habitat can include all Columbia River Basin waterways, substrates, and adjacent riparian areas below longstanding, natural impassable barriers (e.g., natural waterfalls in existence for at least several hundred years) and dams that block access to former habitat.

NMFS designated CH for SRF Chinook to include the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) and including all Columbia River estuarine areas and river reaches proceeding upstream to the confluence of the Columbia and Snake Rivers; the Snake River, all river reaches from the confluence of the Columbia River, upstream to Hells Canyon Dam; the Palouse River from its confluence with the Snake River upstream to Palouse Falls; the Clearwater River from its confluence with the Snake River upstream to its confluence with Lolo Creek; the North Fork Clearwater River from its confluence with the Clearwater River upstream to Dworshak Dam. Critical habitat also includes river reaches presently or historically accessible (except reaches above impassable natural falls, and Dworshak and Hells Canyon Dams) to SRF Chinook salmon in the following hydrologic units; Clearwater, Hells Canyon, Imnaha, Lower Grande Ronde, Lower North Fork Clearwater, Lower Salmon, Lower Snake, Lower Snake-Asotin, Lower Snake-Tucannon, and Palouse. Critical habitat borders on or passes through the following counties in Oregon: Baker, Clatsop, Columbia, Gillium, Hood River, Morrow, Multnomah, Sherman, Umatilla, Wallowa, Wasco; the following counties in Washington: Adams, Asotin, Benton, Clark, Columbia, Cowlitz, Franklin, Garfield, Klickitat, Lincoln, Pacific, Skamania, Spokane, Wahkiakum, Walla Walla, Whitman; and the following counties in Idaho: Adams, Benewah, Clearwater, Idaho, Latah, Lewis, Nez Perce, Shoshone, Valley.

4.5.2.2. Essential Elements of Designated Critical Habitat

Refer to Table 9.

4.5.3. Snake River Sockeye

4.5.3.1. Geographical Extent of Designated Critical Habitat

The proposed dredging will occur within designated critical habitat for Snake River sockeye salmon. Freshwater critical habitat includes all Columbia River Basin waterways, substrates, and adjacent riparian areas below longstanding, natural impassable barriers (e.g., natural waterfalls in existence for at least several hundred years) and dams that block access to former habitat.

NMFS designated critical habitat for Snake River sockeye to include the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) and including all Columbia River estuarine areas and river reaches upstream to the confluence of the Columbia and Snake Rivers; all Snake River reaches from the confluence of the Columbia River upstream to the confluence of the Salmon River; all Salmon River reaches from the confluence of the Snake River upstream to Alturas Lake Creek; Stanley, Redfish, Yellow Belly, Pettit, and Alturas Lakes (including their inlet and outlet creeks); Alturas Lake Creek, and that portion of Valley Creek between Stanley Lake Creek and the Salmon River. Critical habitat is comprised of all river lakes and reaches presently or historically accessible (except reaches above impassable natural falls, and Dworshak and Hells Canyon Dams) to Snake River sockeye salmon in the following hydrologic units: Lower Salmon, Lower Snake, Lower Snake-Asotin, Lower Snake-Tucannon, Middle Salmon-Chamberlain, Middle Salmon-Panther, and Upper Salmon. Critical habitat borders on or passes through the following counties in Oregon: Clatsop, Columbia, Gillium, Hood River, Morrow, Multnomah, Sherman, Umatilla, Wallowa, Wasco; the following counties in Washington: Asotin, Benton, Clark, Columbia, Cowlitz, Franklin, Garfield, Klickitat, Pacific, Skamania, Wahkiakum, Walla Walla, Whitman; and the following counties in Idaho: Blaine, Custer, Idaho, Lemhi, Lewis, Nez Perce.

4.5.3.2. Essential Elements of Designated Critical Habitat

Refer to Table 9.

4.5.4. SRB Steelhead

4.5.4.1. Geographical Extent of Designated Critical Habitat

The proposed dredging will occur within proposed CH for Snake River steelhead. NMFS designated CH for Snake River steelhead in the Hells Canyon, Imnaha River, Lower Snake/Asotin, Upper Grande Ronde River, Wallowa River, Lower Grande Ronde, Lower Snake/Tucannon, Upper Salmon, Pahsimeroi, Middle Salmon-Panther, Lemhi, Upper Middle Fork Salmon, Lower Middle Fork Salmon, Middle Salmon-Chamberlain, South Fork Salmon, Lower Salmon, Little Salmon, Upper Selway, Lower Selway, Lochsa, Middle Fork Clearwater, South Fork Clearwater, and Clearwater subbasins, and the Lower Snake/Columbia River migration corridor (NMFS 2005b). There are 289 watersheds within the range of this DPS. Fourteen watersheds received a low conservation value rating, 44 received a medium conservation value rating, and 231 received a high conservation value rating. The lower Snake/Columbia River rearing/migration corridor downstream of the spawning range is considered to have a high conservation value and is the only portion designated in 15 of the high value watersheds. Of the 8,225 miles of habitat areas eligible for designation, 8,049 miles of stream and 4 square miles of lake are designated.

4.5.4.2. Essential Elements of Designated Critical Habitat

Refer to Table 10.

Table 10 Primary constituent elements (PCEs) of critical habitats designated for Pacific salmon and steelhead species (EXCEPT Snake River spring/summer run Chinook salmon, Snake River fall-run Chinook salmon, and Snake River sockeye salmon), and corresponding species life history events.

Primary Constituent Elements		Species Life History Event
Site Type	**Site Attribute**	
Freshwater spawning	Substrate Water quality Water quantity	Adult spawning Embryo incubation Alevin development
Freshwater rearing	Floodplain connectivity Forage Natural cover Water quality Water quantity	Fry emergence Fry/parr growth and development
Freshwater migration	Free of artificial obstructions Natural cover Water quality Water quantity	Adult sexual maturation Adult upstream migration, holding Kelt (steelhead) seaward migration Fry/parr seaward migration
Estuarine areas	Forage Free of obstruction Natural cover Salinity Water quality Water quantity	Adult sexual maturation Adult "reverse smoltification" Adult upstream migration, holding Kelt (steelhead) seaward migration Fry/parr seaward migration Fry/parr smoltification Smolt growth and development Smolt seaward migration
Nearshore marine areas	Forage Free of obstruction Natural cover Water quantity Water quality	Adult sexual maturation Smolt/adult transition
Offshore marine areas	Forage Water quality	Adult growth and development

4.5.5. Bull Trout

4.5.5.1. Geographical Extent of Designated Critical Habitat

Bull trout CH was designated in 2005. The USFWS revised the designation in 2010. A final rule was published on October 18, 2010, and took effect on November 17, 2010. The mainstem Columbia and Snake Rivers, including the action area, are now included in the designation.

4.5.5.2. Essential Elements of Designated Critical Habitat

PCEs for bull trout (Table 11) are based on the needs identified in 50 CFR 17 (75 FR 63898) and the current knowledge of the life-history, biology, and ecology of the species and the characteristics of the habitat necessary to sustain the essential life history functions of the species. The USFWS has identified the following PCEs for bull trout critical habitat.

Table 11 Primary constituent elements (PCEs) of critical habitats designated for bull trout.

PCEs		
1	Water Quality	Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.
2	Migration Habitat	Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.
3	Food Availability	An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.
4	Instream Habitat	Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.
5	Water Temperature	Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.
6	Substrate Characteristics	In spawning and rearing areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.
7	Stream Flow	A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph.
8	Water Quantity	Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.
9	Nonnative Species	Sufficiently low levels of occurrence of nonnnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

4.5.6. Canada Lynx

No critical habitat for Canada Lynx has been designated within the proposed action area. The proposed action will have no effect on lynx critical habitat.

4.5.7. Pygmy Rabbit, Ute Ladies'-tresses, Spalding's Catchfly

No critical habitat rules have been published for pygmy rabbit, Ute ladies'-tresses, or Spalding's catchfly.

5. Environmental Baseline

The action area directly affected by the proposed action begins at the confluence of the Snake and Clearwater Rivers (approximately RM 139) at Lewiston, ID and Clarkston, WA and extends downstream to the Ice Harbor Dam navigation lock approach (approximately RM 10). The action area also extends upstream from the confluence of the Clearwater and Snake Rivers to about RM 1.2 on the Clearwater River. Both adult and juvenile life stages of each of the aforementioned ESUs use the action area as a migration corridor. The action area also provides a limited amount of spawning and rearing habitat for SRF Chinook salmon, although very little SRF Chinook salmon spawning occurs in the mainstem lower Snake River below the Snake and Clearwater River confluence. Some adult Snake River steelhead and juvenile SRSS Chinook salmon also overwinter in the action area. The action area includes areas directly and indirectly affected by the proposed action. The entire action area is designated EFH for Chinook salmon, and portions are designated EFH for coho salmon.

Dams

Dam development in the Columbia River Basin began in the 1800s. Mainstem dam development began with Rock Island Dam (a non-Federal project) on the Columbia River in 1933 and continued through 1975 with the completion of Lower Granite on the Snake River. Bonneville Dam was the first Federal dam on the mainstem Columbia River. It was completed in 1938. The major period of construction on the mainstem Columbia and Snake Rivers was from the 1950s through the 1970s. Federal agencies have built 30 major dams with hydropower facilities on the Columbia and its tributaries. Overall, there are some 255 Federal and non-Federal projects that have been constructed in the basin. These dams have altered the sediment transport function of many parts of the rivers, especially at the uppermost dams, such as Lower Granite Dam.

The lower Snake River dams have disrupted sediment transport and habitat-forming deposition patterns within the entire length of the river channel. As the Snake and Clearwater Rivers meet the slackwater of the Lower Granite reservoir, bedload and suspended particles soon settle to the river bottom, resulting in a substantial accumulation of sediment near the head of the reservoir. An estimated 2.6 million cubic yards of sediment enter the Lower Granite reservoir each year. Without the dams, finer-grained materials will tend to be deposited on the river floodplain or high along the channel margins, and the riverbed will present a complex mosaic of substrate conditions along the length of the lower Snake River.

Presently, there are few shallow-water sandy shoals below the confluence area. Consequently, smolts must travel substantial distances between foraging areas, feeding during their seaward migration. There are also few accumulations of suitable spawning gravels for SRF Chinook salmon except for a limited amount in the tailraces of the dams.

Storage dams have eliminated mainstem spawning and rearing habitat. They have altered the natural flow regime of the Snake and Columbia Rivers by decreasing spring and summer flows, increasing fall and winter flow, and altering natural thermal patterns. Power operations cause fluctuating flow levels and river elevations, affecting fish movement through reservoirs, disturbing riparian areas and, possibly, stranding fish in shallow areas as flows recede. The eight dams in the migration corridor of the Snake and Columbia Rivers kill or injure a portion of the smolts passing through the area. The low velocity at which water travels through the reservoirs behind the dams slows the juvenile salmonids travel time to the ocean and enhances the survival of predatory fish (Independent Scientific Group 1996). Formerly complex mainstem habitats in the Snake River have been reduced to single, simple, reservoir-wide channels with reduced floodplains in size and function, and off-channel habitats eliminated or disconnected from the main channel (Sedell and Froggatt 1984; Independent Scientific Group 1996; and Coutant 1998). The amount of large woody debris in the river has declined, reducing habitat complexity and altering the river’s food webs (Maser and Sedell 1994).

Soils

The soils along the lower Snake River can be primarily divided into three types: upland soils along the hillslopes and canyons, alluvial soils along the river, and bench soils along the ridgetops and terraces above the river. The upland soils are primarily shallow to very deep, silty loam soils formed from loess deposits and residuum from basalt. These soils tend to have a high-to-severe erosion hazard due to rapid runoff along the steep slopes of the canyon. The bench-type soils tend to be sandy loam developed from glacial outwash, loess, volcanic ash, and basalt. These bench-type soils have slow runoff characteristics and slight erosion hazards because they tend to be on less steep slopes. Alluvial soils are found in the valley bottom and are excessively drained and range from cobbley, coarse sand underlain by stratified cobbles, boulders, gravels, and sand. These alluvial soils were more subject to periodic flooding prior to river impoundment.

Many of the Snake River Plateau soils are light and highly erodible with low rainfall limiting the ability of vegetative cover to reestablish, once removed. Wind erosion is prevalent, especially during the spring and fall, when high winds and dry soil conditions create dust storms. The severity of these dust storms is exacerbated by dryland agricultural practices that expose the soil during spring cultivation and fall harvesting.

Erosion from areas burned by forest fires and plowed for agriculture are two of the main factors that contribute sediment to the rivers. The use of no-till farming practices reduces the sediment input from agriculture. Landslides in burned areas contribute large amounts of sediment. Landslides of various types also occur along the reservoir shorelines. These landslides are generally within the surface layer sediments, especially those that are somewhat poorly drained because of an admixture of finer grained sediment.

The lower Snake River downstream of Lewiston, Idaho annually transports approximately 3 to 4 million cubic yards of new sediments which have been eroded from its drainage basin. Approximately 100 to 150 million cubic yards of sediment have been deposited upstream of the four lower Snake River dams (mostly in Lower Granite Reservoir) since Ice Harbor became operational in the early 1960s.

Other Baseline Conditions

Other human activities that have degraded aquatic habitats or affected native fish populations in the Snake River Basin include stream channelization, elimination of wetlands, construction of flood control dams and levees, construction of roads, water withdrawals, unscreened water diversions, agriculture, livestock grazing, urbanization, outdoor recreation, artificial fish propagation, fish harvest, and the introduction of non-native species (Henjum et al. 1994; Rhodes et al. 1994; Spence et al. 1996). In many watersheds, land management and development activities have: (1) reduced connectivity (i.e., the flow of energy, organisms, and materials) between streams, riparian areas, floodplains, and uplands;
(2) elevated fine sediment yields, degrading spawning and rearing habitat; (3) reduced large woody material that traps sediment, stabilizes streambanks, and helps form pools; (4) reduced

the vegetative canopy that minimizes the solar heating of streams; (5) caused streams to become straighter, wider, and either shallower or deeper than their historic or normative condition, thereby reducing rearing habitat and altering water temperature; (6) altered peak flow volume and timing, leading to channel changes and potentially altering fish migration behavior; and (7) altered floodplain function, water tables, and base flows (Henjum et al. 1994; Rhodes et al. 1994; Wissmar et al. 1994; Spence et al. 1996).

Although currently fragmented by the presence of dams, the mainstem Snake River provides habitat that may help to maintain interactions between populations in the tributaries. It currently provides for the foraging and overwintering of all ESA-listed Snake River salmonids except sockeye salmon (Table 12), and could provide some spawning habitat for SRF Chinook salmon.

Table 12 Absolute and Relative Quantification of Three Water Depth Habitats in the Lower Granite Reservoir, Snake River and Clearwater River During the Early to Mid-1980's

Pool Reach (RM)	**Shallow (<20 ft) Acres (Percent)**	**Mid-Depth (20-60 ft) Acres (Percent)**	**Deep (>60 ft) Acres (Percent)**	**Total Acres (Percent of Total Pool or Reach)**
SR107.4 – SR120.46	281 (8%)	1,241 (34%)	2,147 (57%)	3,669 (43%)
SR120.46 - SR146.33	983 (8%)	2,795 (58%)	1,017 (21%)	4,795 (57%)
SR107.4 – SR146.33	1,264 (15%)	4,036 (48%)	3,164 (37%)	8,464 (94%)
CR0.0 - CR4.4	349 (71%)	141 (29%)	0 (0%)	489 (6%)
SR107.4 - SR146.33 and R0.0 - CR4.4	1,612 (18%)	4,177 (47%)	3,164 (35%)	8,953 (100%)

Notes:
(1) Estimates calculated from U.S. Army Corps of Engineers cross section profiles.
(2) SR120.46 is the mid-reservoir section where the majority of the fine silt and sand material settles out due to increased rate of depth affecting the slowing rate of water velocity.

Turbidity

The turbidity standards in Washington and Idaho differ slightly. Washington regulations specify that turbidity shall neither exceed 5 NTUs over background levels when the background level is 50 NTUs or less nor have more than a 10 percent increase when background is more than 50 NTUs. The Idaho standard states that turbidity shall not exceed the background by more than 50 NTU instantaneously below the compliance boundary or by more than 25 NTU for more than 10 consecutive days.

Background turbidity data collected from the lower Snake River indicates that turbidity was lowest at the confluence of the Snake and Clearwater Rivers and increased farther downstream in the Snake River. Median turbidity values ranged from 2 to 4 nephelometric turbidity unit (NTUs) in the Snake River, well below Washington's 25 NTU background action limit. These measurements did not include sampling during periods of heavy runoff or heavy storm non-point source water discharge. The average background turbidity level in the Snake and Clearwater Rivers during the winter dredging period in 2006 was less than 5 NTU.

Chemical Contaminants

The Corps had a series of analyses performed on samples collected in 2011 to determine the chemical content of sediments at potential dredging sites in the lower Snake River and at the confluence of the Snake and Clearwater Rivers. The sediment samples were analyzed for grain size, total organic carbon, percent solids, TAL metals, PCBs (Arochlors), semi-volatile organic compounds, polycyclic aromatic hydrocarbons, total petroleum hydrocarbons (diesel-heavy oil range), halogenated pesticides, organophosphorus pesticides, organonitrogen pesticides, phenylurea pesticides, carbamate pesticides, glyphosate, and high resolution dioxin/furan congeners. Elutriate analyses were also completed for some of samples to evaluate the potential release of constituents from disturbed sediments. The data was compared to the 2009 marine sediment criteria contained in the Sediment Evaluation Framework for the Pacific Northwest (SEF), the Washington State Department of Ecology (WADOE) 2012 sediment management standards (SMS), and the National Oceanic and Atmospheric Administration 2011 Screening Quick Reference Tables (NOAA SQRT) for invertebrates.

Grain size data from the three DMMUs characterized the majority of the material proposed for dredging as sand with smaller amounts of silts near the mooring areas. The majority of the individual organic parameters were non-detectable. Low level dichlorprop (10 ppb) was detected in one elutriate sample from the Clarkston DMMU but did not trigger any of the criteria previously mentioned. Most of the metals data met the guidelines as well. One exception was the mercury concentration in one sediment sample from the Clarkston DMMU which was 0.009 ppb above the NOAA SQRT recommended invertebrate no effect level, but less than the SEF and SMS criteria. Dioxin and furan toxic equivalents (TEQs) were calculated for the sediment and elutriate using the U = 0 and U = ½ method for comparisons. These TEQs were consistent with the results of previous studies in agricultural soils in Washington and less than Puget Sound background levels.

5.1. Matrix of Pathways and Indicators (MPI)

NMFS uses the "Matrix of Pathways and Indicators" (MPI) (NMFS 1996) to summarize important environmental parameters and levels of condition for each (Table 13). USFWS adopted a similar strategy in 1997 based on NMFS' matrix. The NMFS matrix is divided into six overall pathways (major rows in the matrix):

- Water Quality
- Channel Condition and Dynamics
- Habitat Access
- Flow/Hydrology
- Habitat Elements
- Watershed Conditions

Each represents a significant pathway by which actions can have potential effects on anadromous salmonids and their habitats, and could be used for analyzing bull trout habitat as well.

When the Lower Granite reservoir was filled in 1975, the historical shallow-water habitat was inundated. This converted approximately 40- to 60-percent of the shallow-water sand bar habitat used by juvenile fall Chinook salmon into either mid-depth bench habitat or deep-water habitat. Mid-depth bench habitat is more suitable for sturgeon (with minimal structural cover) or adults of resident predator species (with structure in the substrate); and deep-water habitat is used by only a few species, including sturgeon.

An analysis of limiting conditions for reservoir-wide habitat readily indicates that low gradient, open sand, shallow-water habitat (with no additional cover structure) will be moderately to highly suitable for fall Chinook salmon rearing habitat (Bennett et al. 1987 through 2005, Curet 1994, and Connor et al. 2001, 2002, 2003, 2004; Tiffan and Connor 2012; Tiffan and Hatten 2012). Recent biological monitoring has suggested that reducing the criterion to define shallow water from <20 ft (the COE's current definition) to <6 ft (based on recent habitat use data) would provide the greatest amount of shallow water habitat for subyearling fall Chinook salmon based on habitat use sampling data and their transient rearing strategy and that creating new habitat in the lower portion of Lower Granite Reservoir in ribbons along the shoreline appears to provide the greatest benefit for rearing juvenile fall Chinook (Tiffan and Connor 2012; Tiffan and Hatten 2012).

Recent modeling efforts by Tiffan and Hatten (2012) indicates Lower Granite Reservoir contains about 255 ha of rearing habitat at a flow of 143 kcfs, which equates to about 7% of the reservoir area. This modeling effort demonstrated most rearing habitat is located in the upper half (i.e., upstream of Centennial Island, RM 120) of the Lower Granite reservoir and little exists in the lower half due to steep lateral bed slopes and unsuitable substrate along the shorelines. The largest habitat areas are associated with known shallow-water locations such as at Silcott Island (~85 ha) and the area near Steptoe Canyon (~32 ha).

In previous Section 7 consultations for dredging and disposal actions on the lower Snake River, NMFS has indicated that shallow-water habitat less than 10 feet deep will be preferred as highly suitable for the rearing of juvenile SRF Chinook salmon; and all constructed shallow-water habitat plots should not be located at a single site or one restricted reach of any lower Snake River reservoir. It is preferable to have an interconnected, but wider distribution of "feeding stations." Based on these previous consultations, biological monitoring of shallow water complexes in the lower Snake River reservoirs and recent modeling efforts (Tiffan and Connor 2012; Artzen et al. 2012; Tiffan and Hatten 2012; Gottfried et al. 2011), future disposal of dredge materials should occur in the lower portion of the Lower Granite Reservoir. These will begin in the mid reaches of the Lower Granite reservoir, radiating downriver and taking the fullest advantage of existing shallow to mid-depth benches to build on. The Corps realized that a minimum acreage of constructed habitat for any single disposal action will have to apply to avoid the desire to dump small quantities of excavated sediment with no short-term or long-term benefit, even though a plan could deliver more sediment in the next channel maintenance action.

The Corps did an aerial photography and bathymetry mapping exercise on measuring the size and distribution qualities of pre-reservoir sand and gravel shoreline habitat plots to determine that 4 acres constitutes the minimum rearing habitat benefit acreage. The design conditions proposed by Bennett et al., Curet, Connor et al., NMFS, Tiffan and Connor, Tiffan and Hatten and the Corps were combined to serve as the objective target for maximizing beneficial use of in-water disposal of dredged material.

Table 13 Checklist for Documenting Environmental Baseline and Effects of Proposed Action on Relevant Anadromous Salmonid Habitat Indicators

PATHWAYS	ENVIRONMENTAL BASELINE			EFFECTS OF THE ACTION		
Indicators	Properly Functioning	At Risk	Not Properly Functioning	Restore	Maintain	Degrade
Water Quality:						
Temperature			X		X	
Sediment			X		X	
Chem. Contam./Nut.		X			X	
Habitat Access:						
Physical Barriers		X			X	
Habitat Elements:						
Substrate			X		X	
Large Woody Debris			X		X	
Pool Frequency			X		X	
Pool Quality			X		X	
Off-Channel Habitat			X		X	
Refugia			X		X	
Channel Cond. & Dyn.:						
Width/Depth Ratio			X		X	
Streambank Cond.			X		X	
Floodplain Connectivity			X		X	
Flow/Hydrology:						
Peak/Base Flows			X		X	
Drainage Network Increase			X		X	
Watershed Conditions:						
Road Dens. & Loc.			X		X	
Disturbance History			X		X	
Riparian Reserves			X		X	
Watershed Name: Snake River Basin			Location: Ice Harbor Dam to Lewiston, Idaho			

5.2. Baseline Conditions Justification

The lower Snake River in the action area has been highly altered from its pre-dam condition. As a result many of the parameters below are "not properly functioning."

Water Quality: Temperature – Water temperature in the lower Snake and Clearwater Rivers is not properly functioning. Dams on the Snake River have altered the water temperatures especially during summer and fall. Coldwater releases from Dworshak Dam reduce summertime water temperature in an attempt to create more favorable conditions for migrating juvenile salmonids. During winter, when the proposed action will occur, water temperatures are likely to be similar to historic conditions.

Water Quality: Sediment – Sediment in the Snake River is not properly functioning. Many factors contribute to the altered sediment processes. The aftereffects of forest fires contribute sand and silt to the river systems, especially from the Salmon River basin. While this is a natural process, the frequency of large fires may be on the increase due to years of fire suppression and climate change. Mainstem dams trap sand and larger sediments, especially in areas such as the Snake/Clearwater confluence where faster moving water which can carry sand meets the slackwater reservoir which cannot carry sand very well. Sand and any larger sediments are deposited in these areas in large amounts, causing problems for river navigation.

Water Quality: Chemical Contaminants/Nutrients – The amount of contaminants in the sediments within the action area place this attribute at risk. Various chemical contaminants were detected within the sediments in some locations of the action area. However, the level of contaminants was largely below regulatory thresholds. The majority of the individual organic parameters were non-detectable. Low level dichlorprop (10 ppb) was detected in one elutriate sample, but did not trigger any regulatory criteria. Most of the metals data met the guidelines as well. One exception was the mercury concentration in one sediment sample which was 0.009 ppb above the recommended invertebrate no effect level, but less than the threshold for other criteria. Dioxin and furan toxic equivalents (TEQs) were calculated for the sediment and elutriate using the U = 0 and U = ½ method for comparisons. These TEQs were consistent with the results of previous studies in agricultural soils in Washington and less than Puget Sound background levels.

Habitat Access: Physical Barriers – Physical barriers in the action area make this parameter at risk. A majority of migrating adult and juvenile salmonids can successfully pass the mainstem dams, but passage is sometimes delayed and some fish do not survive the unnatural conditions around the dams. In addition, the slack water reservoirs slow the migration of juveniles which can be detrimental to their survival.

Habitat Elements: Substrate – The substrate condition in the action area is not properly functioning. The dams have halted the bedload movement of most of the gravel and cobble once transported through the system. Sand and gravel bars have mostly been covered by the slackwater reservoir. A faster moving, natural river likely contained more areas of gravel and cobble substrate where higher quality food organisms for juvenile salmonids lived.

Habitat Elements: Large Woody Debris - is not properly functioning. The reservoir conditions make what little large woody debris is on the river nonfunctional as salmonid habitat. Most of the existing woody debris is high up on the shorelines or floats down the river and is trapped behind the dams.

Habitat Elements: Pool Frequency – Pool frequency within the action area is not properly functioning. The slackwater reservoir creates one large pool where many smaller pools intermixed with runs and riffles once occurred.

Habitat Elements: Pool Quality – The pool quality in the action area is not properly functioning. Cover in the pool is provided mainly by water depth. Nonnative species/competitors reduce the amount of quality habitat for salmonids even further.

Habitat Elements: Off-Channel Habitat – The amount of off channel habitat in the action area is not properly functioning. Off-channel habitat in the form of side channels and backwater areas are limited within the lower Snake River. Areas which once contained shallow water habitat are now covered by many feet of reservoir water.

Habitat Elements: Refugia – The amount of refugia in the action area is not properly functioning. This parameter is closely related to the limited amount of large woody debris, large particle size substrate and overhead cover now available in the lower Snake River. Refugia on the mainstem river is now provided mainly by water depth.

Channel Condition and Dynamics: Width to Depth Ratio – The width to depth ratio of the Snake River in the action area is not properly functioning. The width to depth ratio of the lower Snake River has been altered since construction of the dams.

Channel Condition and Dynamics: Streambank Condition – The streambank condition in the action area is not properly functioning. Some of the streambanks in the lower Snake River have been lined with riprap. This protects the banks from erosion, but reduces the amount of riparian vegetation that is able to grow along the river.

Channel Condition and Dynamics: Floodplain Connectivity – The floodplain connectivity in the action area is not properly functioning. Prior to construction of the Snake River dams, the river had a wide floodplain. With the presence of the dams and the controlled reservoir elevation, the floodplain is dramatically reduced in width.

Flow/Hydrology: Peak/Base Flows – The peak and base flows in the action area is not properly functioning. The Snake River's peak flow has declined since larger storage Dams were constructed. Likewise baseflow has been increased as stored water is released during dry months of the year.

Flow/Hydrology: Drainage Network Increase – The drainage network in the action area is not properly functioning. Cities and towns increase the amount of impervious surface which causes water to run off the land quicker than normal. Plowed agricultural fields don't retain as much water after storms than naturally vegetated land. Snow on clearcut forests may melt sooner causing higher peak flows and lower base flows.

Watershed Conditions: Road Density and Location – The road density and location within the action area is not properly functioning. The presence of roads in the watershed can cause large amounts of fine sediment to erode into the streams and rivers of the watershed.

Watershed Conditions: Disturbance History – The disturbance history of the action area is not properly functioning. Many factors have caused disturbance to the Snake River watershed. Agriculture, forestry, road building, and stream channel straightening/altering have had great impacts on the watershed.

Watershed Conditions: Riparian Reserves – The amount of riparian reserves within the watershed is not properly functioning.   In the past riparian vegetation was removed along many sections of the Snake River and its tributaries.

6. Effects of the Action

6.1. Approach to the Analysis

The approach to the effects analysis used the following questions (adapted from Johnson 2009) to determine the extent, if any, of potential effects, and justify the effects determination for each species. The fish species, with the exception of the upper and middle Columbia River stocks are analyzed collectively and their outcomes from the questions below are bolded. Since upper and middle Columbia spring Chinook and steelhead only occur below Ice Harbor Dam and any effects from removing the large sediment from the lock approach will not cause a turbidity plume, we conclude the proposed project may affect, but is not likely to adversely affect these species.

1. Is the proposed action likely to produce potential stressors or subsidies that will reasonably be expected to act directly on individual organisms or to have direct or indirect consequences (positive or negative) on the environment?

    a. An answer of "no" to #1 will result in a "no effect" determination by the Corps.
    b. An answer of "yes" to #1 will result in moving to #2.

2. If the proposed action is likely to produce those potential stressors, are endangered or threatened individuals likely to be exposed to one or more of those potential stressors or subsidies or one or more of the proposed action's direct or indirect consequences on the environment?

    a. An answer of "no" to #2 will result in a "no effect" determination by the Corps.
    b. An answer of "yes" to #2 will result a "may affect" determination by the Corps, and moving to #3.

3. If listed individuals are likely to be exposed, are those listed individuals likely to respond, positively or negatively, to that exposure?

    a. An answer of "no" to #3 will result in a "not likely to adversely affect" determination by the Corps.
    b. An answer of "yes" to #3 will result in moving to #4.

4. If listed individuals are likely to respond, are those responses likely to be sufficient to reduce their individual performance?

    a. An answer of "no" to #4 will result in a "not likely to adversely affect" determination by the Corps.
    b. An answer of "yes" to #4 will result in a "likely to adversely affect" determination by the Corps. This determination, for any potential effect, and for any given species, will result in a "may affect, likely to adversely affect" determination for that species.

Based on these questions, the Corps concludes there may be potential stressors produced as a result of the proposed action, and ESA-listed species may be exposed to those stressors.

Those species that are listed in the counties in which Corps lands are within, but that do not occur within the action area either spatially or temporally, will not be exposed to potential stressors, and, according to 2.a. in Section 6.2.1 (above), a “no effect” determination can be made for those species (Table 14).

Conversely, according to 2.b. in Section 6.2.1 (above), a “may affect” determination must be made for those species that occur in spatial and temporal proximity of the proposed action in the action area (Table 14).

Table 14 May Affect determinations based on spatial and temporal proximity of the species to the proposed action.

Species	Species Determination
NMFS	
Snake River Spring/Summer Chinook	May Affect
Snake River Fall Chinook	May Affect
Snake River Sockeye	May Affect
SRB Steelhead	May Affect
USFWS	
Bull trout	May Affect
Pygmy Rabbit	No Effect
Canada lynx	No Effect
Ute ladies’-tresses	No Effect
Spalding’s’ catchfly	No Effect

Exposure to potential stressors will be reduced by the implementation of the proposed conservation measures.

6.2. Response Analysis

If the individuals are exposed to potential stressors, then an analysis of the response must take place to gauge the effect on the individual. An individual fish may respond directly or indirectly to exposure to stressors. Examples are:

- Species
  - Mortality
  - Behavioral modification
  - Reduced predator avoidance
  - Reduced growth and reproduction
  - Physiological
  - Habitat alteration

- Critical habitat
  - Alteration of spawning gravels

- Reduction in prey species
- Water quality
- Reduction in riparian vegetation

Responses are a function of the likelihood of exposure, and the extent of that exposure to potential stressors, combined with reductions in that likelihood and extent due to conservation measures. Responses are specific to the type of stressors, and will be identified as such in each potential effect section.

The exposure profile combined with the response profile will determine the effect to the species and designated critical habitat. Potential effects will be minimized by the implementation of proposed conservation measures in the form of IMMs and BMPs.

6.3. Project Effects

Since the proposed project is confined entirely to the river, there will be no effect to any of the terrestrial plant or animal species.

Upper Columbia River (UCR) spring Chinook ESU and UCR and Middle Columbia River (MCR) steelhead DPS boundaries do not include the Snake River. Though they could stray into the Snake River protection for them would then be provided by the ESA coverage for Snake River species.

Project-related effects include direct disturbance by equipment at the dredging and disposal sites. Indirect effects to fish will occur from elevated turbidity levels downstream from the dredging and disposal sites. There is also always a chance for petroleum products to leak into the water from the equipment which will negatively impact aquatic life. The impact to prey species is also an indirect effect.

6.4. Effects on Listed Species

The Corps anticipates that project-related effects will be similar for all Snake River listed fish species that may occur within the action area, including bull trout, and will therefore be analyzed collectively. MCR and UCR steelhead and UCR spring Chinook could stray up to the Ice Harbor navigation lock approach, but if they enter the Snake River, ESA projection is provided by the coverage for SRSS Chinook and steelhead. Straying would be unpredictable and presumably in very low numbers. Because of this, effects are discountable, and warrant a “not likely to adversely affect” determination for these species.

Maintaining the Federal navigation system through the lower Snake River reservoirs indirectly affects the subject listed species by enabling habitat-affecting activities such as commercial barging in the mainstem Snake River. Juvenile salmonids, particularly sub-yearling fall Chinook, require the availability of interconnected shallow-water rearing habitat. Dredging deepens portions of the habitat while disposal in mid-depth areas can create more suitable salmon rearing habitat. In order to increase the likelihood of survival and recovery of the listed species, widespread habitat conditions in the action area need to improve.

The dredged sediment will be used to construct a uniform sand-dominated substrate, gently sloping (2-percent cap over a 3- to 5-percent base), shallow-water habitat resembling a sand bar with features optimized for resting/rearing of outmigrating juvenile salmonids, and targeted towards SRF Chinook salmon production. While it may be possible to return to this disposal area and deposit more sediment in future years, the disposal bench will be designed so that it provides the maximum benefit possible with the quantity of dredged material available from the proposed alternative. As such, adding sediment to the bench in future years is not a requirement to realize a benefit to rearing juvenile salmonids as part of this proposed action. For example, dredge materials were deposited immediately upstream of the proposed disposal location during a previous action in 2005/2006 and appear to have been successful at creating shallow-water habitat beneficial to rearing juvenile fall Chinook (Tiffan and Connor 2012; Artzen et al. 2012). Middle and Upper Columbia River steelhead and Upper Columbia spring Chinook will not be affected by the dredged material placement.

Prior to the use of the Knoxway Canyon disposal site, it was a mid- to shallow-depth bench composed of silt accumulated on the left bank. Since visual inspection of this site in 1992, habitat suitability has been poor for rearing and overwintering due to the thick silt layer accumulating at about 2 inches per year for 25 years (approximately 4 feet) over a sand base (less than 20-percent composition). Habitat suitability for spawning is nonexistent. The disposal work in 2005/2006 created a shallow water area with a sand substrate.

The Corps has continued to focus on evaluating the effects of creating in-water habitat for juvenile fall Chinook salmon. Up to 24 sampling sites have been examined in the lower Snake River reservoirs, including resurveys of the backwater of Knoxway Canyon at the tributary mouth (RM 115.9), which has been used as a reference site in the larger reservoir habitat studies (Gottfried et al. 2011; Artzen et al. 2012; Tiffan and Connor 2012). Results from Bennett et al. (2003, 2004) indicate that, compared to all reservoir sites sampled, the established reference site located within the bay at Knoxway Canyon produced the highest density of benthic macroinvertebrates throughout both the summer and fall/winter samples, but not the greatest biomass. This is a positive result, because high density in these samples represents insect larvae preferred by salmonids as prey, whereas biomass represents few, but heavy bodied mollusk species that are typically uningestable by juvenile salmonids. Monitoring for fish species composition and abundance (fish use) found that the Knoxway Canyon reference site is moderately used by juvenile SRF Chinook salmon, marginally used by SRSS Chinook salmon, marginally used by major predator species (smallmouth bass and northern pikeminnow), and not used by SRB steelhead (Bennett et al. 2003, 2005).

Beneficial Use of Dredged Material

It has been demonstrated through many years of research and monitoring in and outside of the lower Snake River corridor that juvenile fall Chinook salmon prefer shallow, open, sandy areas along shorelines for rearing (Bennett et al., 1994, 1997, 2005; Connor et al. 2004; Tiffan and Connor 2012). Research and effectiveness monitoring showed that SRF Chinook salmon used the shallow-water habitat created with in-water disposal of dredged material including areas that surround Centennial Island (Lower Granite reservoir, near Snake RM 120). In some years, as many as 10 percent of the total sample of subyearling Chinook salmon from the Lower Granite reservoir originated from the habitat created by in-water disposal. Bennett reported that SRF Chinook salmon were most commonly collected over lower gradient shorelines with low velocities and sandy substrate, most represented by the opposing sand bars and the scalloped shoreline series of sand bars observed in the historical river (1944 and 1958 aerial photography on file at the Corps, Walla Walla District). Habitat having these physical characteristics can be effectively constructed in any of the lower Snake River reservoirs with the appropriate placement of dredged material. Although previous Corps monitoring results indicate this type of construction could provide resting and rearing habitat for ESA-listed species, some resource agencies question the benefits. They consider the shallow-water rearing habitat restoration efforts in the Lower Granite reservoir to be generally beneficial, but still experimental. Previous ESA Section 7 informal and formal consultations for dredging coordinated with NMFS (NMFS 1992, 1997, 1998, and 1999; NMFS 2001, 2002, and 2003, 2005) have supported the proposal to develop this type of habitat provided that the Corps follows a monitoring plan to verify post-construction effectiveness and use by ESA-listed species.

The in-water disposal site at Knoxway Canyon (RM 116) was selected because it is on the inside of a river bend, has suitable water velocities and underwater contours to facilitate shallow-water habitat creation, and is configured so the sediment can be deposited without burying known cultural resource sites. The Corps selected this site because it is close to the confluence (where most of the dredging will occur), has potential to provide suitable resting/rearing habitat for juvenile salmonids once the river bottom is raised, will not interfere with navigation, will not impact cultural/historic properties, and is of sufficient size to accommodate the anticipated dredged sediment disposal volume.

Short-term construction-related effects warrant a “likely to adversely affect” determination for SRF Chinook, SRSS Chinook, SRB steelhead, SR sockeye, and bull trout. Long-term effects from the disposal are anticipated to be beneficial to SRF Chinook, SRSS Chinook, SRB steelhead, SR sockeye, and bull trout.

6.4.1. Direct Effects from Equipment

Direct effects from the clamshell dredge are possible, but not very likely. At the Lewiston/Clarkston sites and the disposal site adult steelhead, bull trout, and some juvenile Chinook and steelhead may be present during the winter in-water work window. Individual fish could be killed or trapped as the bucket is dropped into the river. The determination for this activity is “likely to adversely affect” for the listed fish species. However, adult steelhead and bull trout will likely be scared away from the dredging activity, so the likelihood of one being trapped or killed is unlikely. Juvenile fish are also likely to avoid the immediate area around the dredge. The same scenario holds for the sediment removal work below Ice Harbor Dam, except adult upper and middle Columbia steelhead may also be present. There is very low likelihood any adult fish will be impacted by the dredging work.

The area below the Ice Harbor navigation lock identified for dredging will be surveyed for SRF Chinook redds prior to the dredging work. If redds are identified, work at the site will stop and

NMFS will be contacted for further coordination prior to continuation of dredging activities. The proposed work below Ice Harbor is “not likely to adversely affect” listed fish species.

At the disposal site fish could be directly crushed by the material being dumped out of the barge, however this is unlikely due to the minimal number of salmonids likely to be present during this time period, the likelihood any that are present will be pelagically oriented, the loud nature of the equipment likely allowing individuals to quickly egress from the area (Tiffan and Connor 2012; Artzen et al. 2012). The use of the clamshell dredge at this location to reposition the dredged material to create shallow water habitat could also affect individual fish, though as for the initial dredging, the chance of this type of impact is low. These reasons lead to a “likely to adversely affect” determination for SRF Chinook, SRSS Chinook, SRB steelhead, SR sockeye, and bull trout.

6.4.2. Elevated Suspended Sediment and Turbidity

Dredging and disposal of dredged material will resuspend some fine sediment. High levels of suspended sediment and turbidity can result in direct mortality of fish by damaging and clogging gills (Curry and MacNeill 2004). Sublethal levels of suspended sediment may cause undue physiological stress on fish, which may reduce the ability of the fish to perform vital functions (Cederholm and Reid 1987).

The introduction of sediment in excess of natural amounts can have multiple adverse effects on bull trout and their habitat (Berry et al. 2003; Rhodes et al. 1994). The effect of sediment beyond natural background conditions can be fatal at high levels. Other salmonids are affected in the same way. No threshold has been determined in which fine-sediment addition to a stream is harmless (Suttle et al. 2004). Even at low concentrations, fine-sediment deposition can decrease growth and survival of juvenile salmonids.

Sigler et al. (1984) found that a reduction in growth occurred in steelhead and coho salmon when turbidity was as little as 25 NTUs. The slower growth was presumed to be from a reduced ability to feed; however, more complex mechanisms such as the quality of light may also affect feeding success rates.

Large bull trout may feed almost exclusively on fish. While low levels of turbidity and suspended sediment may not directly impact bull trout, the increased sediment input may affect prey for bull trout. The following effects of sediment are not specific to bull trout alone. All salmonids can be affected similarly.

Newcombe and Jensen (1996) developed a scale of severity from suspended sediment on salmonids. Table 15 (Table 1 from Newcombe and Jensen 1996) shows the scale. Based on the near-real time monitoring which allows rapid response to elevated turbidity levels and the low turbidity levels recorded during the Corps 2005/2006 dredging effort we estimate the severity level to be between 1 and 5.

Table 15 Severity scale of excessive suspended sediment on salmonids (Table 1 from Newcombe and Jensen 1996).

Table 1 – Scale of the severity (SEV) of ill effects associated with excess suspended sediment on salmonids.

SEV	Description of Effect
	Nil effect
0	No behavioral effects
	Behavioral effects
1	Alarm reaction
2	Abandonment of cover
3	Avoidance response
	Sublethal effects
4	Short-term reduction in feeding rates; short-term reduction in feeding success
5	Minor physiological stress; increase in rate of coughing; increased respiration rate
6	Moderate physiological stress
7	Moderate habitat degradation; impaired homing
8	Indications of major physiological stress; long-term reduction in feeding rate; long-term reduction in feeding success; poor condition
	Lethal and paralethal effects
9	Reduced growth rate; delayed hatching; reduced fish density
10	0-20% mortality; increased predation; moderate to severe habitat degradation
11	> 20 – 40% mortality
12	> 40 – 60% mortality
13	> 60 – 80% mortality
14	> 80 – 100% mortality

Table 16 is also from Newcombe and Jensen (1996). This table links the severity levels with ESA effect determinations. For juvenile fish the applicable determination for a value of 5 is "likely to adversely affect". Adult or subadult may use the rivers/reservoirs to overwinter, but it is unlikely that juveniles would migrate from their natal streams to use the action area during the proposed work period.

Table 16 ESA Effect calls for different bull trout life stages in relation to the duration of effect and severity of ill effect. Effect calls for habitat, specifically, are provided to assist with analysis of effects to individual bull trout

	SEV	ESA Effect Call
Egg/alevin	1 to 4	Not applicable - alevins are still in gravel and are not feeding.
	5 to 14	LAA - any stress to egg/alevin reduces survival
Juvenile	1 to 4	NLAA
	5 to 14	LAA
Subadult and Adult	1 to 5	NLAA
	6 to 14	LAA
Habitat	1 to 6	NLAA
	7 to 14	LAA due to indirect effects to bull trout

The monitoring program for the 2005/2006 dredging was designed to monitor parameters on a near real-time basis as dredging progressed. Water quality monitoring ensured the activities of dredging and disposal of sediments met the terms and conditions of the Water Quality Certifications specified by the States of Washington and Idaho and the Endangered Species Act (ESA). The Port of Lewiston, Project 4000 did not experience any exceedence of turbidity levels according to Idaho state standards of 50 NTU above background station readings. The other monitoring stations saw very low exceedences above the 5 NTU standard. Table 17 shows the average turbidity values above 5 NTU for the 2005/2006 dredging and disposal work. The highest average turbidity was only 15 NTU.

The material to be removed below Ice Harbor Dam is larger gravel and cobble, mostly free of fines. Removal of this material is not likely to create a turbidity plume downstream. Some Chinook, steelhead and a few bull trout may be found in the area, but impacts will be minimal at this site.

Table 17 Average turbidity values above the WA State water quality standard of 5 NTU.

Lower Monumental Dam Project 1000

Station	300		400		900	
Depth	Deep	Shallow	Deep	Shallow	Deep	Shallow
Total Project Hours	175	175	175	175	175	175
Exceedance Hours	3	0	35	24	27	25
Percent in Compliance	98.29%	100.00%	80.00%	86.29%	84.57%	85.71%
Average Turbidity Over	1.22	0.00	9.63	6.95	8.26	5.47

Lower Granite Dam Project 2000

Station	300		400		900	
Depth	Deep	Shallow	Deep	Shallow	Deep	Shallow
Total Project Hours	6	6	6	6	6	6
Exceedance Hours	0	1	0	0	0	1
Percent in Compliance	100.00%	83.33%	100.00%	100.00%	100.00%	83.33%
Average Turbidity Over	0.00	1.03	0.00	0.00	0.00	1.93

Port of Clarkston WA Project 3000

Station	300		400		900	
Depth	Deep	Shallow	Deep	Shallow	Deep	Shallow
Total Project Hours	851	851	851	851	851	851
Exceedance Hours	90	16	301	168	129	60
Percent in Compliance	89.42%	98.12%	64.63%	80.26%	84.84%	92.95%
Average Turbidity Over	4.58	2.62	5.84	3.87	4.62	3.86

Disposal Site Project 7000

Station	300		400		700	
Depth	Deep	Shallow	Deep	Shallow	Deep	Shallow
Total Project Hours	1665	1665	1665	1665	1665	1665
Exceedance Hours	206	62	167	30	179	14
Percent in Compliance	87.63%	96.28%	89.97%	98.20%	89.25%	99.16%

Overall, effects lead to a “likely to adversely affect” determination for SRF Chinook, SRSS Chinook, SRB steelhead, and SR sockeye. A “not likely to adversely affect” determination for bull trout is warranted, based on the information above.

6.4.3. Effect on Prey Species

Distance of prey capture and prey capture success both were found to decrease significantly when turbidity was increased (Berg and Northcote 1985; Sweka and Hartman 2001; Zamor and Grossman 2007). Waters (1995) states that loss of visual capability, leading to reduced feeding, is one of the major sublethal effects of high suspended sediment. Increases in turbidity were reported to decrease reactive distance and the percentage of prey captured (Bash et al. 2001; Klein 2003; Sweka and Hartman 2001). At 0 NTUs, 100 percent of the prey items were consumed; at 10 NTUs, fish frequently were unable to capture prey species; at 60 NTUs, only 35 percent of the prey items were captured. At 20 to 60 NTUs, significant delay in the response of fish to prey was observed (Bash et al. 2001). Loss of visual capability and capture of prey leads to depressed growth and reproductive capability.

Macroinvertebrate numbers in the dredging and disposal areas will decline due to the action. These areas are likely to repopulated within several months. This impact on prey items will cause an indirect effect on listed fish. This leads to a “likely to adversely affect” determination for SRF Chinook, SRSS Chinook, SRB steelhead, SR sockeye, and bull trout.

6.4.4. Chemical Contamination

Operation of equipment requires the use of fuel and lubricants, which, if spilled into the channel of a waterbody or into the adjacent riparian zone, can injure or kill aquatic organisms. Petroleum-based contaminants contain poly-cyclic aromatic hydrocarbons (PAHs), which can be acutely toxic to salmonids at high levels of exposure and can cause lethal and sublethal chronic effects to other aquatic organisms (Neff 1985). Equipment will be inspected and cleaned prior to any instream work. Because of the nature of operating large equipment on a barge which is floating on the river, an accidental discharge could occur. A spill would call for a “likely to adversely affect” determination for for SRF Chinook, SRSS Chinook, SRB steelhead, SR sockeye, and bull trout. However, implementation of standard BMPs associated with this type of work reduces the likelihood of a spill to a level that is not reasonably certain to occur. Because of implementation of the BMPs, chemical contamination is discountable, and, therefore “not likely to adversely affect” any of the fish species.

Monitoring of contaminants in the sediment to be dredged was conducted in 2011. Only a very small number of samples contained contaminants higher than Washington and Idaho regulatory criteria.

6.5. Effects on Critical Habitat

Those critical habitats that are designated for species in the counties in which Corps lands are within, but that do not occur within the action area, will not be exposed to potential stressors, a “no effect” determination can be made for those species. All of the fish species have designated critical habitat within the action area. Since there will be in-water work in areas where the listed fish species occur, the appropriate determination for all of the fish species is “may affect” (Table 18).

Table 18 May Affect determinations based on spatial and temporal proximity of proposed and designated critical habitat to the proposed action.

Species	Critical Habitat Determination
NMFS	
Snake River Spring/Summer Chinook	May Affect
Snake River Fall Chinook	May Affect
Snake River Sockeye	May Affect
SRB Steelhead	May Affect
USFWS	
Bull trout	May Affect
Pygmy Rabbit	None Designated
Canada lynx	No Effect
Ute ladies'-tresses	None Designated
Spalding's' catchfly	None Designated

6.5.1. Snake River Spring/Summer Chinook, Fall Chinook, Steelhead, and Sockeye

6.5.1.1. Spawning and Juvenile Rearing Areas

Cover/shelter: The only spawning habitat in the action area is below each of the Snake River dams, where SRF Chinook sometimes spawn. There is adequate depth in these areas which provides cover for both spawning and rearing Chinook. Some marginal SRF Chinook spawning habitat has been found downstream from the proposed dredging site below Ice Harbor Dam (Mueller and Coleman 2007, 2008). The proposed project will not change the amount of cover available below the dams.

The part of the action area above Lower Granite Dam contains rearing area mainly for juvenile Snake River steelhead and SRF Chinook. Water depth is the main feature providing cover in these areas as well. The proposed project will not affect the amount of cover available for these ESU/DPSs.

Food (juvenile rearing): The dredging and disposal actions could decrease the amount of food available to juvenile salmonids for a few months. Aquatic organisms which these fish feed on will be removed with the dredged material. At the disposal site aquatic food items will be buried with up to several feet of material. There could be a decrease in the amount of food items available to juvenile salmonids rearing in these areas. Once the shallow water habitat is placed and has time to repopulate with benthic organisms, more food items will be available for juvenile fish.

Riparian vegetation: The proposed action will not affect riparian vegetation.

Space: The proposed action will not affect the amount of space available to ESA listed fish species.

Spawning gravel: The cobble/gravel in the navigation lock approach could be suitable for SRF Chinook spawning. Redd surveys will be conducted prior to removing the sediment. Removal of the material could decrease the amount of spawning habitat available below Ice Harbor Dam.

Water quality: Turbidity is the main water quality factor that will be affected by the proposed action. The turbidity level below the Ice Harbor navigation lock approach is not likely to increase because there is no fine sediment in the material to be dredged. However, the turbidity generated by the upriver in-water work (around the Snake/Clearwater confluence and at the disposal site) will eventually be deposited as fine sediment in downstream substrates. Much of the accumulated sediment is sand which will settle out of the water relatively rapidly. Some of the material to be dredged is silt, so some substrate embeddedness in areas downstream of the dredge may temporarily increase as a result. Some of the fine sediment will be remobilized downstream during the next high flow event, though most will likely continue to accumulate in the slack water of the reservoir. The turbidity data collected upstream and downstream of the disposal location during the 2005/2006 channel maintenance project does show a few instances of elevated turbidity values. Washington State standards were exceeded by a small amount for short periods. Average turbidity values did not exceed 15 NTU (Table 17).

During the two and a half months when monitoring occurred 24-hrs per day, the number of instances when four-hour criteria was exceeded ranged from zero to two at the three shallow sondes, and from three to ten at the deep sondes. These events were primarily the outcome of scows releasing dredged material. It should be noted that between scows, which arrived approximately every six hours, turbidity levels returned to background levels for several hours prior to the subsequent scow.

Sediment samples have been taken throughout the action area to measure the levels of pollutants in the sediment. As previously mentioned, very low levels of contaminants were found in a small number of the sediment samples.

There will be no increase in water temperature as a result of the proposed action.

Water quantity: The proposed action will have no effect on water quantity.

6.5.1.2. Juvenile Migration Corridors

Cover/shelter: The proposed action will occur during winter when juvenile salmonids will not be migrating. The main cover feature in the Snake River is provided by water depth. There will be no measurable effect on cover from the proposed action.

Food: There will be a decrease in the abundance of macroinvertebrates for a few months from the dredging and disposal actions within the action area. At the dredging sites, juvenile fish prey items will be removed from the river. Downstream from the dredging sites fine material will settle out of the water column and reduce the number of macroinvertebrates available as prey items. Prey items will also be buried under several feet of dredged material at the disposal site. This will decrease the amount of prey items available to juvenile salmonids during the first year after placement.

Riparian vegetation: The proposed action will have no effect on riparian vegetation.

Safe passage: The proposed action will not affect safe passage through the downstream migration corridor.

Space: There will be no effect on the amount of space available within the juvenile migration corridor.

Substrate: Part of the juvenile migration corridor will be affected by the dredging and disposal upstream from Lower Granite Dam. Most of the existing substrate is sand and the streambed will remain covered with sand after the proposed work. However, there will be some silt resuspended in the water column which will settle out downstream causing some embeddedness of sand or gravel areas downstream. Some of the fine sediment will be remobilized and move further downstream during the next high flow event.

At the disposal site, the silty bottom will be covered with additional silt and sand to create shallow water habitat for juvenile SRF Chinook.

At the Ice Harbor navigation lock approach gravel and cobble will be removed, leaving a gravel, cobble and bedrock bottom.

Water quality: Water quality will have returned to normal prior to the juvenile out-migration timeframe. The proposed action will have no effect on water quality during the juvenile migration season.

Water quantity: The proposed action will have no effect on water quantity.

Water temperature: The proposed action will have no effect on water temperature.

Water velocity: The proposed project will have no measurable effect on water velocity.

Areas for growth and development to adulthood: The proposed creation of shallow water habitat at the disposal site will increase the amount of area available for juveniles to rear; especially SRF Chinook. The dredging action both at the Snake/Clearwater confluence and at the Ice Harbor navigation lock approach will not affect areas of growth and development of juvenile salmonids.

Ocean areas: The proposed action will have no effect on ocean areas.

6.5.1.3. Adult Migration Corridors

Cover/shelter: The proposed action will have no effect on cover available to adult salmonids.

Riparian vegetation: The proposed action will have no effect on riparian vegetation.

Safe passage: The proposed action will have no effect on safe passage for adult salmonids in the Snake River.

Space: The proposed action will have no effect on the amount of space available to adult salmonids.

Substrate: Areas of sand will generally remain as sandy areas after completion of the proposed action. The proposed action will not affect the substrate in the adult migration corridor.

Water quality: Adult steelhead will be in the action area during the winter in-water work period. The turbidity generated by the upriver in-water work (around the Snake/Clearwater confluence and at the disposal site) will eventually be deposited as fine sediment in downstream substrates. Much of the accumulated sediment is sand which will settle out of the water relatively rapidly. Some of the material to be dredged is silt, so some substrate embeddedness in areas downstream of the dredge may temporarily increase as a result. Some of the fine sediment will be remobilized downstream during the next high flow event, though most will likely continue to accumulate in the slack water of the reservoir. The turbidity data collected upstream and downstream of the disposal location during the 2005/2006 channel maintenance project does show a few instances of elevated turbidity values. Washington State standards were exceeded by a small amount for short periods. Average turbidity values did not exceed 15 NTU (Table 17).

Sediment samples have been take to analyze the level of any pollutants that could be resuspended by the proposed action. Contaminants were only found at very low levels in a small number of samples which will not affect the adult migration corridor.

Water temperature: No measurable increases in water temperature will result from the proposed action.

Water velocity: There will be no effect to water velocity due to the proposed action.

6.5.2. Bull Trout

The mainstem Snake and Clearwater Rivers are designated as foraging, migration, and overwintering critical habitat for bull trout. Few bull trout are expected to be in the action area during the proposed work, but winter is the most likely time of year for them to be found there.

Water quality: Water quality will be affected by the proposed project. The main water quality parameter that will be affected is turbidity. Turbidity levels will be monitored near real-time to enable adjustment of the work to keep turbidity levels below regulatory thresholds. During the previous dredging and disposal effort, turbidity levels exceeded state standards by 1 to 10 NTU for up to 301 (nonconsecutive) hours.

Bull trout (and other salmonids) could be negatively affected by high turbidity levels. Even at lower levels there could be some negative effects.

Migration corridors: Increased turbidity levels could have a negative effect on bull trout migration corridors. However, the increased turbidity will not span the entire width of the river. Bull trout could swim around the turbidity plume.

Food availability: Any bull trout residing in the Snake or Clearwater Rivers during winter are likely to be larger sub-adults and adults which prey mainly on smaller fish. Smaller fish are likely to be attracted to the churned up work area as food items are mobilized. This could lead bull trout into the turbidity plume to prey on the small fish. While bull trout may find food, they will also be exposed to increased levels of turbidity which could be harmful to them.

Instream habitat: The proposed project will have a minor effect on foraging, migration and overwintering habitat for bull trout while the work is occurring. The river is quite large and this type of habitat is not limited, so the effect on bull trout will be minimal.

Water temperature: The proposed project will have no effect on water temperature.

Substrate characteristics: Most of the material to be dredged is sand. As sand is removed, some will be suspended in the water column. Sand will redeposit on the riverbed a short distance downstream. Any silt in that is suspended will move further downstream before redepositing. Silt will cover the existing substrate (most likely sand) which could have a negative effect on any macroinvertebrates on the riverbed.

Stream flow: The proposed project will have no effect on stream flow.

Water quantity: The proposed project will have no effect on water quantity.

Nonnative species: The proposed project will have no effect on nonnative species.

6.5.3. Pygmy Rabbit

No critical habitat rules have been published for the Pygmy rabbit.

6.5.4. Canada Lynx

No critical habitat for Canada lynx has been designated within the proposed action area.

6.5.5. Ute ladies'-tresses

No critical habitat rules have been published for the Ute ladies'-tresses.

6.5.6. Spalding's Silene

No critical habitat rules have been published for Spalding's silene.

6.6. Effects from Interdependent and Interrelated Actions

Based on over 10 years of data, all anticipated indirect effects from interdependent or interrelated actions will likely not be significant. They occur as part of the environmental baseline. The experimentation data compiled by Bennett et al. (1987 through 2005), NMFS (Ledgerwood et al. 1997, and subsequent Section 7 consultations), and USFWS (Connor et al. 2001, 2004), indicate that the previous loss of shoreline sandbar habitat could be mitigated. Studies conducted by Bennett et al.; Tiffan and Connor (2012); and Tiffan and Hatten 2012) indicate there may be beneficial uses of the dredged material in the reservoir as long as certain criteria are followed in the selection and placement of the material. Shallow water habitat will be created with dredged material. This habitat is especially important to juvenile SRF Chinook.

Dredging of port basins should provide little increased use in the number of net commercial and recreational vessels or commercial tour boat ventures. Since the depth of the navigation channel and all access channels remains relatively shallow, at 14 feet for shallow-draft vessels, it is anticipated that no deep-draft vessels will be capable of utilizing the dredged areas.

Restoring the navigation channel and berthing areas to a minimum depth of 14 feet at the MOP will allow the reservoir to be operated at MOP which is the most favorable operation for juvenile salmonids as per the 2008 FCRPS and the 2010 Supplement.

Channel maintenance will provide safer access to port facilities for commercial barges. The risk of grounding a barge will be greatly reduced. This will decrease the chance of pollutants being released into the river.

6.7. Cumulative Effects

Given the geographic scope of the action area, which encompasses numerous government entities exercising various authorities, an analysis of cumulative effects is difficult. State and local governments may be faced with pressures from population growth and movement. Such population trends will place greater overall and localized demands on the action area, affecting water quality directly and indirectly, and the need for transportation and communication will proportionately increase. The effects of private actions are the most uncertain. Private landowners may convert their lands from current uses, or they may intensify or diminish those uses. Based on the population and growth trends, cumulative effects are likely to increase.

The navigation channel and berthing areas have been dredged multiple times in the past. The normal process currently was to do the work during winter when fewer ESA-listed species are present. A clamshell bucket was normally used as opposed to a suction dredge, which could more easily entrain fish.

The additional acres of shallow-water habitat will be expected to provide long-term cumulative benefits for the aquatic ecosystem. Juvenile SRF Chinook will likely have the greatest benefit from the increased shallow water rearing habitat.

Impacts from contaminant spills could occur depending on the nature and quantity of the contaminants involved. Even smaller, more frequent spills may add to the degradation of the aquatic environment. These spills may occur at any time throughout the action area, with different parties (local, state, private) responsible for the contamination.

Throughout the action area, much of the land is likely to remain rural and used for agricultural purposes. However, most arable lands have been developed and water resource development has slowed in recent years. Increasing environmental regulations and diversification in local economies has reduced some impacts that have been previously associated with water and land use by agriculture and extractive industries.

There are significant pressures within the State of Washington to begin appropriating water directly from the Columbia and Snake Rivers and from local aquifers that may be hydraulically connected to the Columbia. Furthermore, although the State withdrew the water of the mainstem Columbia and Snake Rivers from further appropriation in 1995, it reopened these rivers for further appropriation in 2002. It is difficult to predict long-term trends in water quantity and quality, but impacts are reasonably certain to continue on some level.

Wetlands are not present at the disposal site. Sanctuaries and refuges, mud flats, vegetated shallows, and riffle and pool complexes are not present at the disposal site. Commercial fishing is not conducted in the vicinity of the proposed disposal site or the dredging sites. Recreational fishing for Snake River steelhead and resident fish does, however, occur in the vicinity. In-water disposal and habitat creation activities may have a localized, short-term impact on recreational fishing in the immediate vicinity of the site. Short-term impacts will be minimized by restricting work to the in-water work window, which does not occur during a period of high recreational use. The creation of shallow-water fish habitat is expected to have a long-term beneficial effect on recreational fisheries.

The Corps also has specific commitments to uphold under the Basin-wide Salmon Recovery Strategy. Of particular significance in this consultation is the Corps' responsibility to operate the lower Snake River dams at MOP during the juvenile out-migration. The proposed dredging will allow this operation to continue without disrupting shipping commerce. The proposed action is consistent with the Corps' responsibilities under the Basin-wide Salmon Recovery Strategy.

Monitoring embankment stability will be accomplished by taking soundings soon after disposal is complete. Soundings will again be taken in the summer after high flows in order to determine if the embankment slumped or moved. This information will be used to make adjustments in the percentage of silt allowable for potential future dredged material placement, and to determine whether or not a berm should be constructed around the toe of the embankment to prevent movement. Monitoring of the biological use of the embankment will be accomplished by sampling fish species presence and abundance in the area post-construction.

6.8. Determination

Each effect was evaluated based on the exposure and response to potential stressors. Although each individual effect had a determination made for it, it is the combined determination for the proposed action for each species and critical habitat that is the ultimate determination that needs to be made. These determinations are based on findings in the exposure and response analyses.

A “no effect” determination was made for those species or critical habitats that are temporally or spatially separated from potential stressors of the action, and could, therefore, not be exposed to potential stressors of the proposed action. Those species that had a “may affect” determination after the exposure analysis went through the response analysis for each potential stressor.

A “not likely to adversely affect” determination was made for those species or critical habitats unlikely to have a response sufficient to reduce their individual performance. A “likely to adversely affect” determination was made for a species as a whole for those likely to have a response sufficient to reduce its individual performance. A “not likely adversely affect” determination was made for critical habitat that may be affected, but for which the conservation value will not be significantly reduced. A “likely to adversely affect” determination for critical habitat was made when habitat value will be significantly reduced.

The combined summary of species and critical habitat determinations is shown in Table 19.

Table 19 Summary of Determination of Effects on Listed Species and Critical Habitat.

Species	Species Determination	Critical Habitat Determination
NMFS		
Snake River Spring/Summer Chinook	**May Affect, Likely to Adversely Affect**	**May Affect, Likely to Adversely Affect**
Snake River Fall Chinook	**May Affect, Likely to Adversely Affect**	**May Affect, Likely to Adversely Affect**
Snake River Sockeye	May Affect, Not Likely to Adversely Affect	**May Affect, Likely to Adversely Affect**
SRB Steelhead	**May Affect, Likely to Adversely Affect**	**May Affect, Likely to Adversely Affect**
USFWS		
Bull trout	**May Affect, Likely to Adversely Affect**	**May Affect, Likely to Adversely Affect**
Pygmy Rabbit	No Effect	None Designated
Canada lynx	No Effect	No Effect
Ute ladies’-tresses	No Effect	None Designated
Spalding’s’ catchfly	No Effect	None Designated

7. Conclusions

This BA documents potential impacts to ESA-listed species that may occur from navigation channel maintenance activities at five sites on the lower Snake River. Up to 500,000 cubic yards of sand, silt, and gravel/cobbles, across 72.5 acres, will be dredged. The dredged sediment will be disposed of at one site to create 3.7 acres of high quality and 11.7 acres of lesser quality shallow-water rearing habitat for the rearing of SRF Chinook salmon.

The purpose of the routine channel maintenance is to provide a 14-foot depth throughout the designated Federal navigation channel in the project area and to restore access to selected port berthing areas. The Corps is working to develop methods to maintain navigation, while avoiding or minimizing negative impacts to the environment. Sediment management is an important aspect of maintaining navigation.

The proposed action: **may affect, and is likely to adversely affect** SRSS Chinook, SRF Chinook, SRB steelhead, and bull trout; **may affect, but is not likely to adversely affect** SR sockeye; **may affect, and is likely to adversely affect** designated critical habitat for SRSS Chinook, SRF Chinook, SRB steelhead, SR sockeye and bull trout**.**

II. Magnuson-Stevens Fishery Conservation and Management Act

The consultation requirement of section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) directs Federal agencies to consult with NMFS on all actions, or proposed actions that may adversely affect Essential Fish Habitat (EFH). Adverse effects include the direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside EFH, and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that may be taken by the action agency to conserve EFH.

The Pacific Fishery Management Council (PFMC) designated EFH for ground fish (PFMC 2005), coastal pelagic species (PFMC 1998), and Chinook salmon, Coho salmon, and Puget Sound pink salmon (PFMC 1999).

The action area includes areas designated as EFH under the MSA for various life-history stages of Chinook and/or Coho salmon (PFMC 1999).

- 17060103 – Lower Snake – Asotin Creek is identified as currently accessible, but unutilized historic EFH for Chinook and Coho.
- 17060107 – Lower Snake – Tucannon River is identified as current EFH for Chinook and currently accessible, but unutilized historic EFH for Coho.
- 17060110 – Lower Snake River is identified as current EFH for Chinook and currently accessible, but unutilized historic EFH for Coho.
- 17060306 – Clearwater River is identified as current EFH for Chinook and currently accessible, but unutilized historic EFH for Coho.

1. Description of the Proposed Action

The proposed action and action area for this assessment are described in the ESA portion of this document.

2. Effects of the Proposed Action

Based on information provided in this BA, and the analysis of effects presented in the ESA portion of this document, the Corps concludes that the effects on Chinook and Coho salmon EFH are the same as those for designated and proposed critical habitat for the fish species listed in this document designated critical habitat and are described in detail in *Effects on Critical Habitat* section of the ESA portion of this document. The proposed action may result in short-term adverse effects on water quality habitat parameters.

2.1. Effects on EFH

Effects on EFH resulting from the proposed action are described in the ESA portion of this document under *Effects to Critical Habitat*.

2.2. Effects on Managed Species

Effects on Chinook salmon resulting from the proposed action are described in the ESA portion of this document.

2.3. Effects on Associated Species, Including Prey Species

Effects on prey species resulting from the proposed action are described in the ESA portion of this document.

2.4. Cumulative Effects

Chinook and coho salmon have been impacted by a wide array of factors related to hatchery impacts, harvest impacts, hydropower impacts, habitat impacts, and ocean conditions. These factors continue to play a role in the response of salmon populations.

Cumulative effects to coho occur from the same sources as those to Chinook. A cumulative effects analysis on Chinook and other ESA-listed species was presented in the preceding ESA assessment.

3. Proposed Conservation Measures

- Conservation measures (IMMs and BMPs) listed in the ESA portion of this document.
- Environmentally critical habitats such as spawning gravels that may be encountered and should be avoided.

4. Conclusions by EFH

Based on the following circumstances and precautions, the Corps believes there will be adverse effects to EFH and on managed species, as described in the ESA portion of this document.

III. Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (FWCA) authorizes the USFWS the authority to evaluate the impacts to fish and wildlife species from proposed Federal water resource development projects that could result in the control or modification of a natural stream or body of water that might have effects on the fish and wildlife resources that depend on that body of water or its associated habitats. This action is maintenance of an existing facility and therefore does not involve activities subject to the FWCA. If structural measures such as dike fields are proposed this Act may apply and the appropriate coordination will be conducted.

IV. Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) (16 U.S.C. §§ 703-712, as amended) prohibits the taking of and commerce in migratory birds (live or dead), any parts of migratory birds, their feathers, or nests. Take is defined in the MBTA to include by any means or in any manner, any attempt at hunting, pursuing, wounding, killing, possessing or transporting any migratory bird, nest, egg, or part thereof.

The proposed action will be conducted in winter, outside of nesting season, and predominantly in and on the Snake River. There is no nesting habitat in the proposed project area. Some waterfowl may be in the area, but will easily avoid the work barges without being harmed. Therefore, the proposed action will not result in taking migratory birds, their nests, eggs, or parts thereof.

V. Bald and Golden Eagle Protection

The Bald and Golden Eagle Protection Act (BGEPA) prohibits the taking or possession of and commerce in bald and golden eagles, with limited exceptions, primarily for Native American Tribes. Take under the BGEPA includes both direct taking of individuals and take due to disturbance. Disturbance is further defined on 50 CFR 22.3.

A few bald eagles winter along the lower Snake River within the action area. Bald eagles could be present near the dredging and disposal sites, but are not likely to be bothered by the work. Bald eagles are known to nest in a few areas of Corps managed lands in the Walla Walla District. Nesting typically begins in March, but there are no known nests near the dredging or disposal areas.

Throughout most of the western United States golden eagles are mostly year-long residents (Polite and Pratt 1999), breeding from late January through August with peak activity in March through July (Polite and Pratt 1999). They may also move down-slope for winter or upslope after the breeding season (Polite and Pratt 1999; Technology Associates 2009). Golden eagles could be located on the cliffs overlooking the lower Snake River, but are unlikely to be disturbed by the proposed project.

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Lower Snake River Programmatic Sediment Management Plan Environmental Impact Statement

Appendix L—Clean Water Act Section 404(b)(1) Evaluation

Prepared by USACE, 2012

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

This 404(b)(1) Evaluation addresses water quality impacts of a proposed in-water discharge of dredged material to be performed by the Walla Walla District Corps of Engineers (Corps) in the first available in-water work window following completion of the Lower Snake River Programmatic Sediment Management Plan/ Environmental Impact Statement (PSMP/EIS). This proposed maintenance dredging would address the immediate need to re-establish the Congressionally-authorized dimensions of the navigation channel in the lower Snake River. Section 404 of the Clean Water Act of 1977 requires that all projects involving the discharge of dredged or fill material into waters of the United States be evaluated for water quality and other effects prior to making the discharge. This evaluation assesses the effects of the discharge utilizing guidelines established by the U.S. Environmental Protection Agency (EPA) under the authority of Section 404(b)(1) of the Act.

2 DESCRIPTION OF THE PROPOSED PROJECT

2.1 Proposed Action

The Corps proposes to perform maintenance dredging at four locations in the lower Snake River and lower Clearwater River in Washington and Idaho (Figure 2-1). One site is the downstream navigation lock approach for Ice Harbor Dam (Figure 2-2) while the other three sites are located at the confluence of the Snake and Clearwater rivers in Lower Granite reservoir. The three sites in Lower Granite are the Federal channel and the berthing areas for the Port of Clarkston and Port of Lewiston (Figures 2-3 through 2-5). The Corps identified a location in the Lower Granite reservoir, Snake River Mile (RM) 116 just upstream of Knoxway Canyon, as the in-water discharge site of the dredged materials. The Corps proposes to use the dredged material to create additional shallow water habitat for juvenile salmonids.

Figure 2-1. Location of dredging and disposal actions

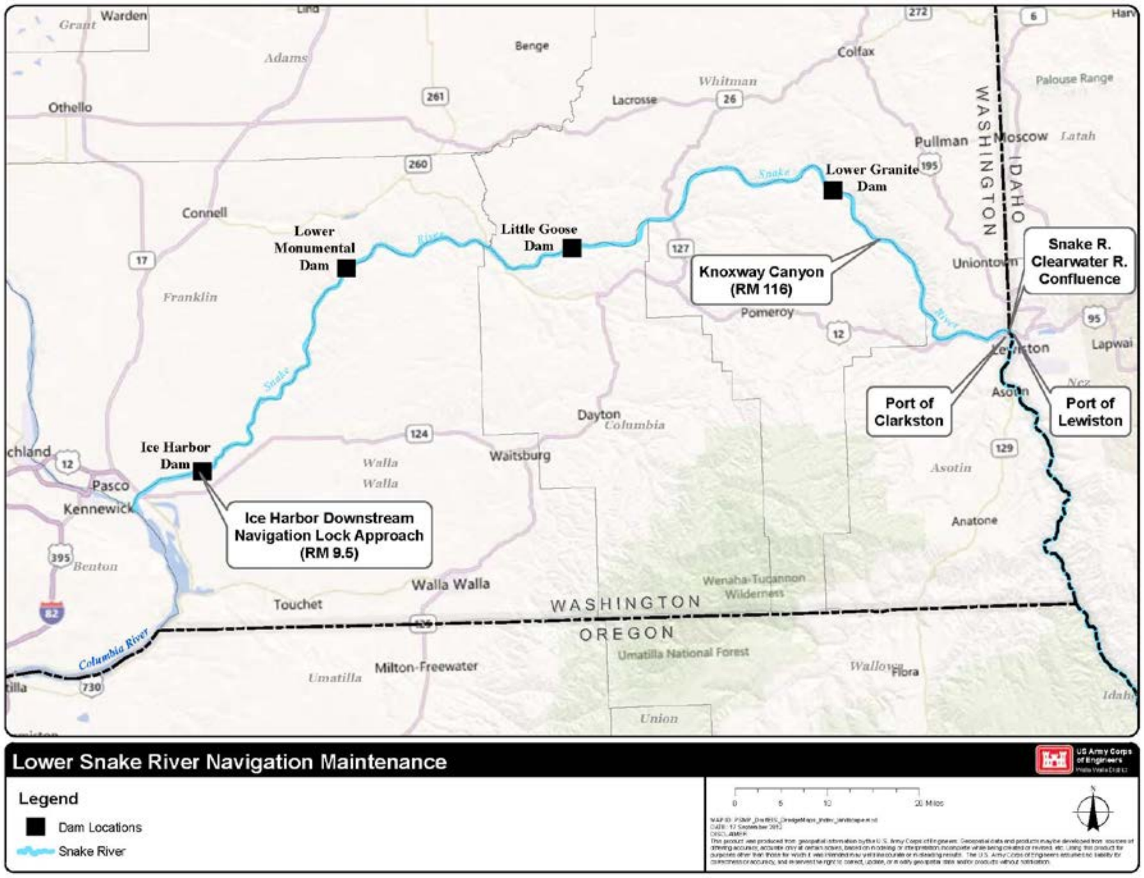


Figure 2-2 Dredging site at Ice Harbor Dam navigation lock

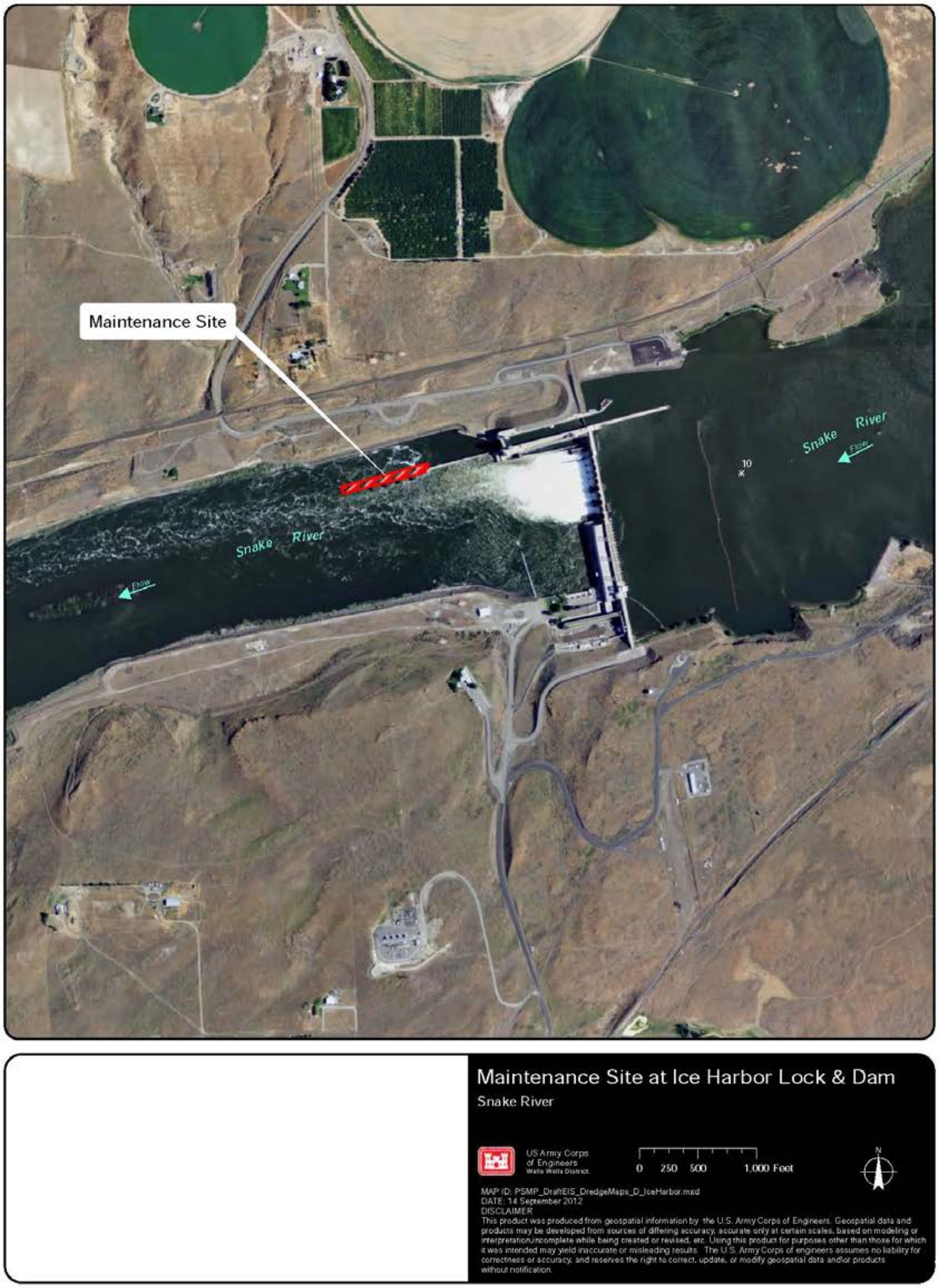


Figure 2-3. Federal channel dredging location at the confluence of the Snake and Clearwater Rivers.

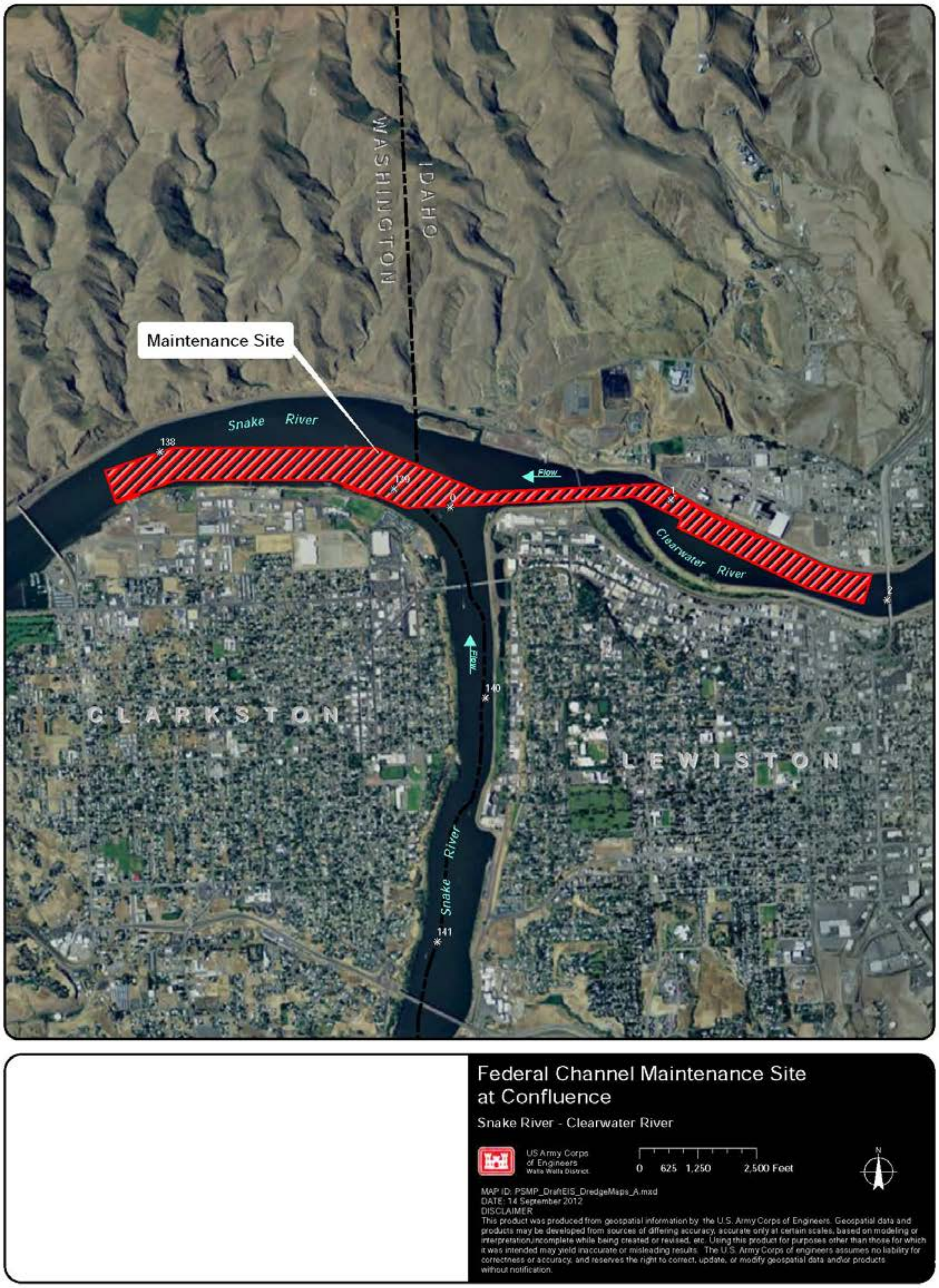
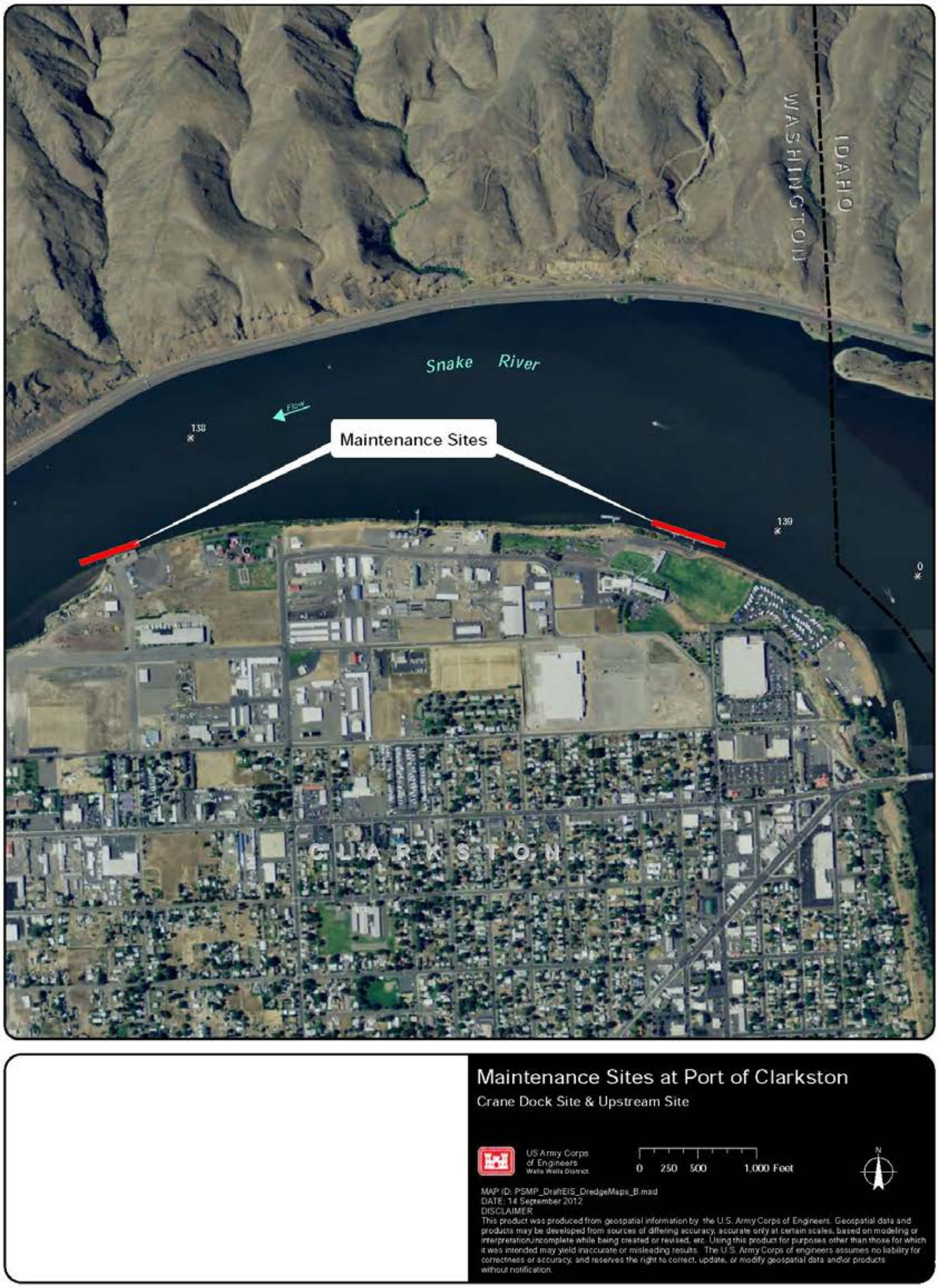


Figure 2-4. Dredging site at the Port of Clarkston


WASHINGTON
IDAHO
Snake River
Flow
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Maintenance Sites
CLARKSTON
Maintenance Sites at Port of Clarkston
Crane Dock Site & Upstream Site
US Army Corps of Engineers
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MAP ID: PSMP_DraftEIS_DredgeMaps_B.mxd
DATE: 14 September 2012
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Figure 2-5. Dredging location at the Port of Lewiston.

2.2 Purpose and Need

The purpose of the immediate need maintenance dredging is to provide a 14-foot depth as measured at minimum operating pool (MOP) throughout the designated Federal navigation channel in the project area and to restore access to selected port berthing areas. The Corps has the responsibility to operate and maintain the authorized Federal navigation channel in the lower Snake River from McNary Reservoir on the mid-Columbia River, up the Snake River to its confluence with the Clearwater River near Clarkston, Washington and Lewiston, Idaho, and up the Clearwater River to the Port of Lewiston. The Corps' authority to maintain the lower Snake River navigation channel was first established in Section 2 of the River and Harbor Act of 1945 (Public Law 79-14, 79th Congress, 1st Session) and approved March 2, 1945, in accordance with House Document 704, 75th Congress, 3rd Session. The Corps is authorized by Congress to maintain a channel that is 250-feet wide and 14-feet deep as measured at minimum regulated flows. Historically, the Corps has routinely maintained the navigation channel through dredging actions to maintain its authorized dimensions, typically every 3 to 5 years. The Corps has not performed maintenance dredging in the channel since the winter of 2005-2006 when the Lower Monumental and Lower Granite downstream navigation lock approaches, the Federal channel at the Snake and Clearwater rivers confluence, and the berthing areas of the Ports of Lewiston and Clarkston were dredged.

An important constraint affecting the Federal navigation channel is Reasonable and Prudent Alternative Action 5 (RPA 5) in the 2008 Federal Columbia River Power System Biological Opinion (FCRPS Bi-Op). RPA 5 states that the lower Snake River reservoirs will be operated within one foot of MOP from April through August each year to help move juvenile threatened and endangered salmon through the river system to the ocean. Operating the reservoirs at MOP versus full pool (a drop in elevation of 3 to 5 feet) is thought to decrease the amount of time downstream migrating juvenile fish spend in the reservoirs, thereby increasing their overall survival rates. Over time, sediment deposition in the navigation channel reduces the water depth to less than 14 feet deep at MOP, which interferes with navigation. RPA 5 allows the reservoir level to be adjusted (i.e. raised) to meet authorized project purposes, primarily navigation, but this deviation from MOP operation is not desirable and the regional fish managers view it as only a temporary measure for addressing sediment deposition in the navigation channel until maintenance can be performed.

Because routine navigation channel maintenance has not occurred since 2005-2006, shoaling in the channel and port berthing areas has become critical in some locations. Sediment has been depositing in these areas in the Snake/Clearwater confluence primarily during spring runoff periods. Survey results from August 2011 show that the total surface area of the Federal navigation channel having depths less than 14 feet, as measured at minimum operating pool (MOP) in the Snake/Clearwater river confluence area has risen from approximately 38 acres in 2010 to approximately 50 acres in 2011, an increase of 31 percent. Water depths in the Federal navigation channel at the confluence are now as shallow as about 7 feet while the berthing areas at the Port of Clarkston and Port of Lewiston are now as shallow as 7.3 feet and 9.3 feet, respectively, based on a MOP water surface elevation. Navigation channel depths less than 14 feet substantially impact access to nearby port facilities.

Because of the shallow depths in the channel, as well as the port berthing areas, some port facilities have been forced to operate at reduced capacity. Impacts to the navigation industry from not providing for the authorized navigation purpose include an increased safety risk, increased risk of damage to equipment, increased risk of grounding, light loading, and lost efficiencies due to modified approach, loading, and unloading procedures. Grounding can cause damage to vessels, which can lead to sinking or capsizing due to holes or rips in hulls, and puts crews and passengers at risk. Since some of the cargo includes petroleum products, fertilizers, and other chemicals, grounding could result in the spilling of harmful cargo. Impacts to commercial navigation from sediment deposition continue even though the operation of one of the four lower Snake River projects (Lower Granite) has been temporarily adjusted to operate at up to two feet above MOP. This deviation from MOP operation is not consistent with the desired operation presented in RPA 5 of the Bi-Op. However, without this temporary, seasonal adjustment, impacts to navigation would be more severe.

Shoaling in the Ice Harbor navigation lock approach is interfering with the ability of barge traffic to safely maneuver when entering or exiting the navigation lock. Spill flows at the dam have scoured rock from the base of the four rock-filled coffer cells bordering the lock approach and have pushed material from the edge of the lock approach into the channel, narrowing the room available for barges to maneuver between the coffer cells and the north shore. At least one of the coffer cells has been losing rockfill through the exposed base and this may be contributing to the material encroaching in the lock approach. This material has created a shoal that encroaches across the south half of the lock approach for about 480 feet, reducing the depth to about 9 feet at MOP in McNary pool (the lock approach is within McNary reservoir, not Ice Harbor reservoir).

2.3 Alternatives Considered

The proposed maintenance action is considered to be an immediate need under the PSMP. As provided for in the PSMP and discussed in Section 2. of the PSMP/EIS, the Corps reviewed the measures available to address an immediate need for sediment deposition affecting commercial navigation and determined dredging was the only measure that would be effective in that timeframe. The Corps considered both upland and in-water disposal options. The “Federal standard” for disposal of dredged material is defined as “[T]he least costly alternatives consistent with sound engineering practices and meeting the environmental standards established by the 404(b)(1) evaluation process. . . ." (33 CFR 335.7). 33 CFR 336.1(c)(1) states, “[I]t is the Corps' policy to regulate the discharge of dredged material from its projects to assure that dredged material disposal occurs in the least costly, environmentally acceptable manner, consistent with engineering requirements . . . .” Additionally, it is the Corps’ policy to always consider beneficial use of dredged material when evaluating disposal options (Engineer Manual 1110-2-5026). As discussed in section 2 and Appendix H of the main report, the Corps determined that upland disposal options were impracticable, mostly because of a lack of a disposal sites within Lower Granite reservoir large enough to accommodate the volume of material that would be dredged and because upland disposal options had higher costs. In-water disposal is the only practicable disposal option available. The Corps identified in-water disposal to create additional shallow-water habitat for juvenile salmonids as the preferred disposal option as it would be a beneficial use of the dredged material and would help offset the potential adverse impacts to salmonids and their critical from the dredging. The Corps selected RM 116 as the preferred disposal site for the immediate need action.

There are several reasons why the Corps selected RM 116 as the site rather than other mid-depth benches in Lower Granite. The site is the closest to the confluence where most of the dredging would occur, therefore the cost to transport the dredged material would be less than for other sites. Looking downstream from the dredging area, it is the first site suitable for creating shallow water habitat downstream of RM 120, the point at which in-water disposal would not raise the water level between the levees at Lewiston. The site is already providing suitable resting/rearing habitat for juvenile salmonids from the previous disposal action and the Corps anticipates the proposed disposal for this immediate need action would provide additional habitat. Disposal at this site would not interfere with navigation or submerged cultural resources. Finally, the site is of sufficient size to accommodate the anticipated dredged material disposal volume.

In selecting dredging with in-water disposal as the proposed immediate need action , the Corps considered several factors including consistency with current Endangered Species Act recovery efforts, environmental impacts, reduction of unsafe conditions in the navigation channel, beneficial use of dredged material, and reasonable implementation costs. The evaluation also included, but was not limited to, the following resource areas: water quality; sediment; air quality; noise; hazardous, toxic, and radioactive waste; aesthetics; anadromous fish, resident fish, plants, threatened and endangered species; recreation; socio-economics; and cultural resources. The Corps determined the proposed action was the most effective action to meet the short term need and was environmentally acceptable.

2.4 General Description of Fill Material

The quantities and types of material proposed for discharge would be obtained from four areas as listed in Table 2-1.

Table 2-1. Sites Proposed for Immediate Need Maintenance Dredging

Site to be Dredged	Quantity to be Dredged (cy)[1]	Type of Material
Federal navigation channel at confluence of Snake and Clearwater Rivers (Snake RM 138 to Clearwater RM 2)	406,595	Sand
Port of Clarkston (Snake RM 137 and 139)	10,220	Sand/Silt
Port of Lewiston (Clearwater RM 1-1.5)	3,000	Sand
Ice Harbor Navigation Lock Approach (Snake RM 9.5)	1,950	Cobble
Total	421,765	

Note: 1. Based on removal to 16 feet below MOP using survey data from November 2011.

The Corps anticipates the maximum quantity needing to be dredged will range from 400,000 cubic yards (cy) to a maximum of 500,000 cy. The majority of the material, up to 407,000 cy, is proposed to be dredged from the Federal navigation channel at the confluence of the Snake and Clearwater Rivers while a small amount of material, 1.950 cy, would be removed from the Ice Harbor lock approach. In general, materials to be dredged are composed mostly of sediments containing a mixture of sand, silt, cobbles, and/or rock. Dredged materials vary with location. Materials to be dredged have been analyzed for grain size distribution and selected chemical parameters. Results of these analyses are described in subsequent sections of this evaluation.

2.5 Description of Proposed Discharge Site

The proposed in-water discharge/habitat development site is located in the Lower Granite reservoir at Snake RM 116. This site is an approximately 120-acre mid-depth bench on the left bank of the Snake River about 0.5 river miles upriver of Knoxway Canyon (see Figures 2-6, 2-7 and 2-8). The Knoxway site was historically an old homestead orchard and pasture located several hundred feet upland of the historic river shoreline. The beneficial use site is located in a low velocity area that has been accumulating sediment at an estimated rate of 2 inches per year since the filling of Lower Granite reservoir. The substrate at this site was visually inspected in 1992 during the reservoir drawdown test. The substrate was observed to be primarily silt. Approximately 4 feet of silt are estimated to cover the bottom of the existing mid- to shallow-depth bench. The upstream end of the site was used as the in-water disposal site for the 2005/2006 channel maintenance dredging. The upper surface of this material is sand that was reshaped to gently slope towards the river.

In 2006, approximately 420,000 cubic yards of sand and silt was deposited on the upriver end of the Knoxway bench. An estimated 3.7-acre shallow water habitat shelf was created for summer rearing juvenile fall Chinook salmon (Figure 2-9). Artzen et al. (2012) using net and snorkel surveys and Tiffan and Connor (2012) using radio-tracking confirmed use of this created habitat by rearing juvenile fall Chinook salmon. The material from the proposed immeidate need dredging would be deposited adjacent to and downstream of the material deposited in 2006. The new material would occupy a 26-acre footprint and would form a uniform, gently sloping shallow-water bench along about 3,500 linear feet of shoreline. The top of the bench would have a 2% slope and would provide about 7.36 acres of additional aquatic habitat up to 6 feet deep at MOP with features optimized for resting/rearing of outmigrating juvenile salmonids, particularly for fall Chinook salmon. The Corps anticipates there would be approximately 18 acres of lesser-quality shallow water habitat at depths of 6 to 20 feet on the slope of the bench.

Proposed in-water work would be conducted during the time period prescribed by applicable regulatory agencies. This time period has been selected to avoid migrations of anadromous salmonids, thus minimizing impacts to these fish. The current in-water work window is December 15 to March 1 for the lower Snake River.

Figure 2-6. Location of proposed disposal site at Knoxway Canyon, RM 116

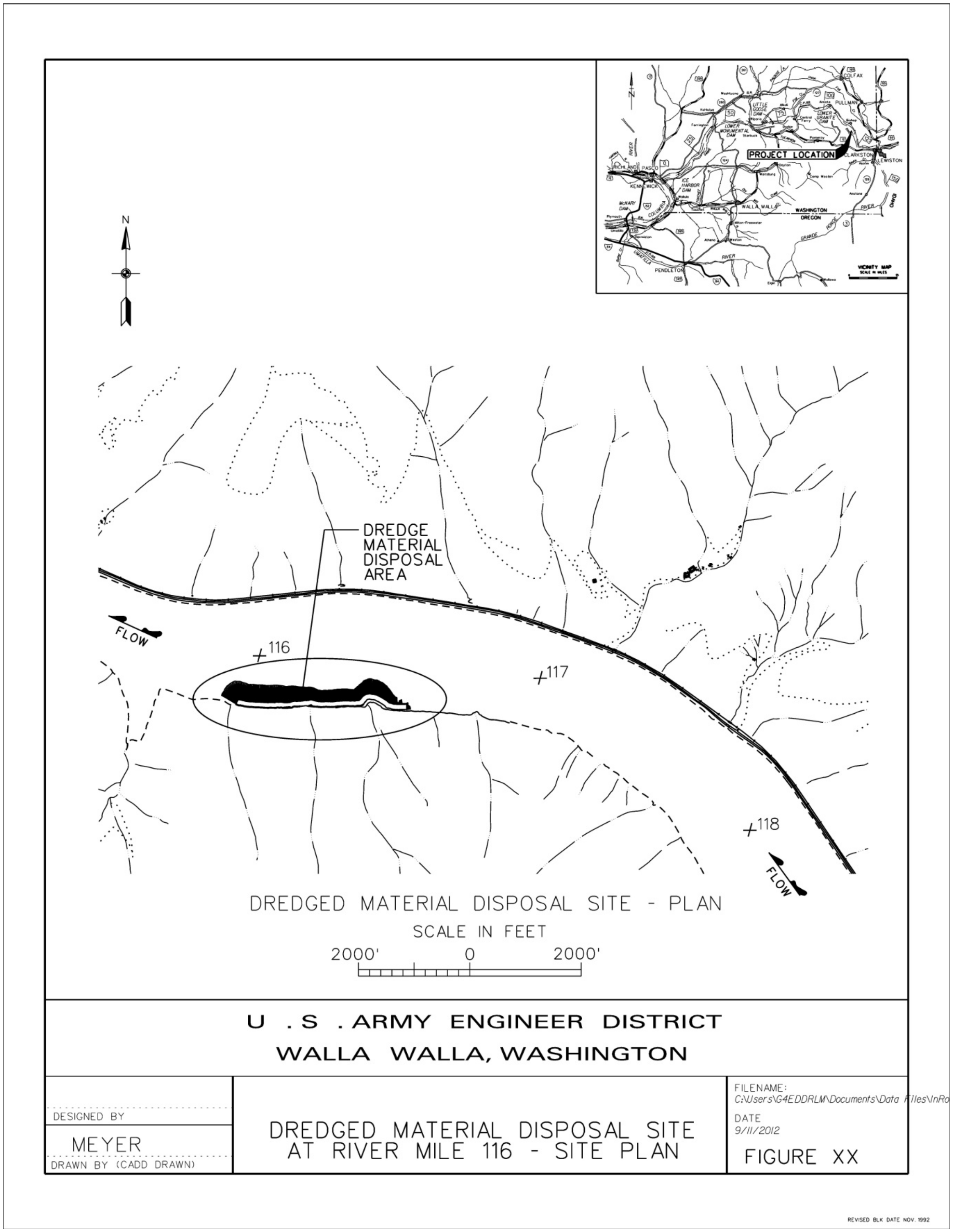


Figure 2-7. Site plan for disposal at RM 116.

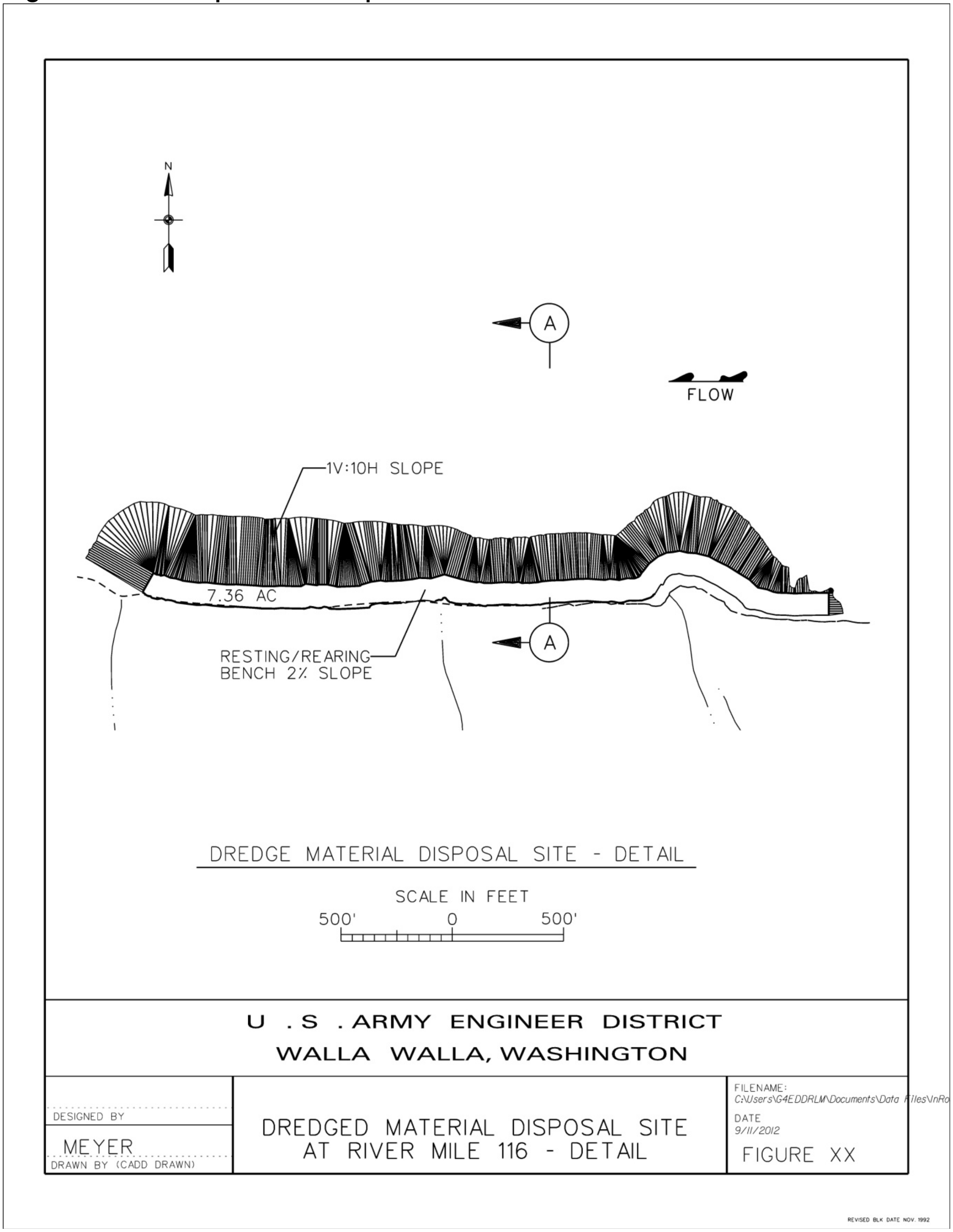


Figure 2-8. Cross section of disposal at RM 116

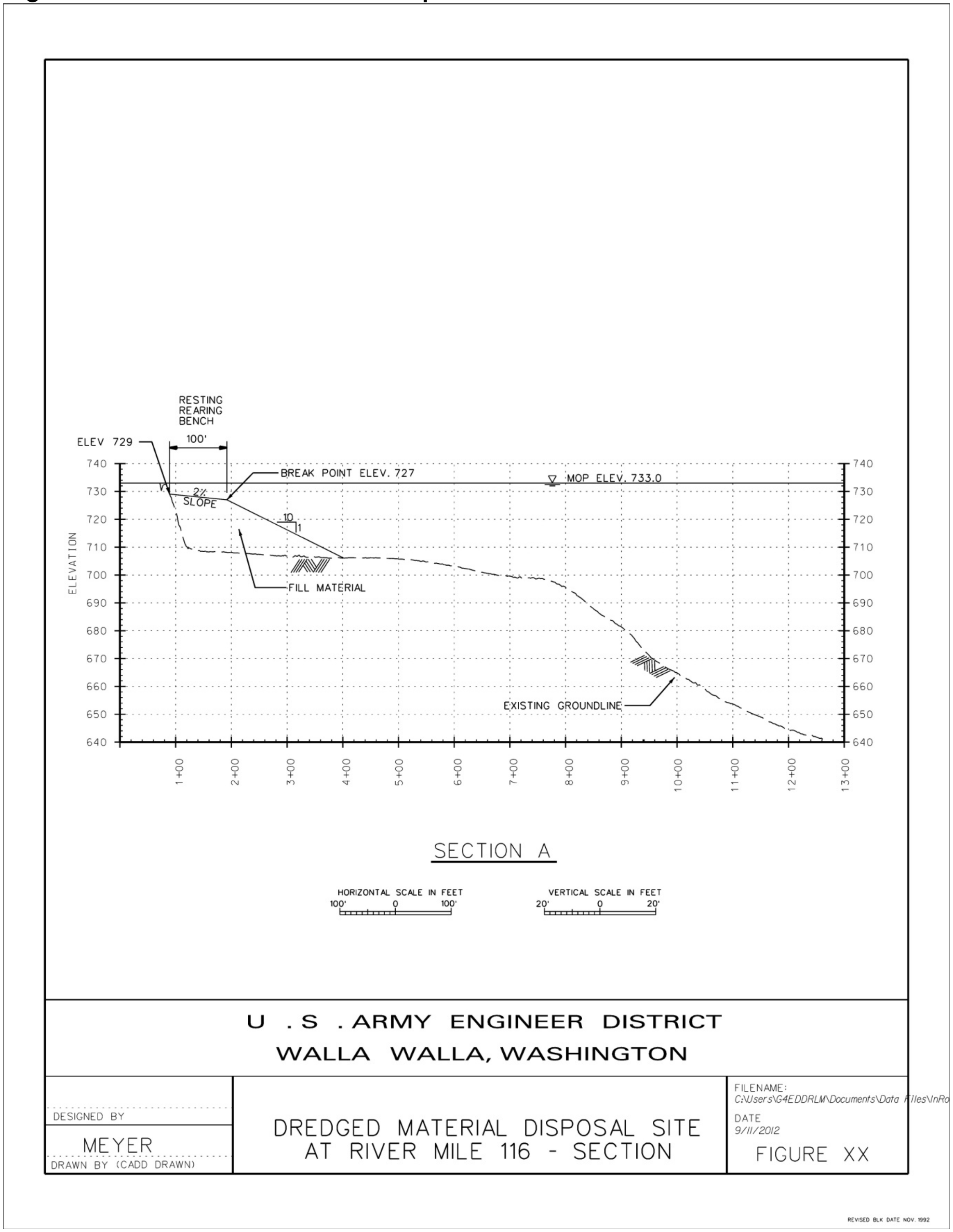
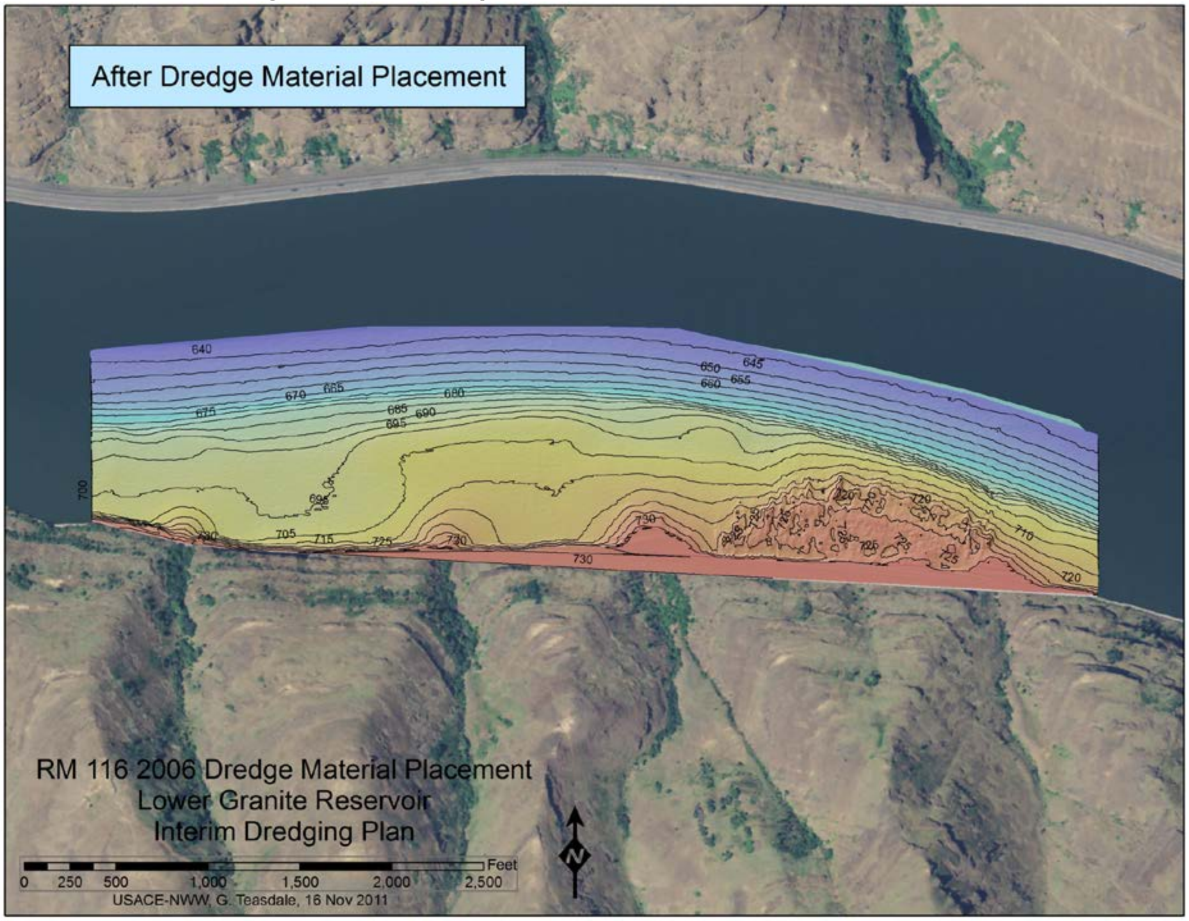


Figure 2-9 Contour map of RM 116 disposal site showing 2005/2006 dredged material placement



2.6 Description of Disposal Method

The overall plan is to place the dredged material in the below-water portion of the bench extending downriver of the material deposited in 2006 and riverward of the existing shoreline. However, rather than place the material in a block as was done in 2006, the Corps would place the material in a "ribbon" along the shoreline. This disposal approach is based on the results of recent biological surveys (Tiffan and Connor 2012, Artzen et al. 2012). These results indicate that a more useful design for the shallow water habitat would be to place the sand and silt material into a narrow band with width of about 50 feet and surface plane depth of 6 feet at MOP elevation of 733 feet that parallels the shoreline. Placement of cobbles, rock, silt, and silt/sand mixture would occur in a manner that would extend the shore riverward along the proposed disposal site to enhance the rearing suitability of the mid-depth habitat bench, by creating a low horizontal slope across the newly created shallow-water rearing habitat. Final grading and/or reshaping to achieve the target slope would occur, if necessary, once disposal of all dredge material is complete.

The disposal process is dependent on the physical characteristics of the dredged material, as well as the potential to optimize the benefit for fish. Dredged materials would be composed of a mixture of silts, sands, gravels, and cobbles. Sediment samples have been taken from the areas to be dredged and have been evaluated for particle size, contaminant levels, and suitability for in-water disposal. Particle-size analysis identified the dredging sites or portions of sites that contain mostly silt, as well as the ones that contain mostly sand or coarser material. Based on previous experience, about 85 percent of the material is expected to be sands (grains greater than 0.0024 inch in diameter) and gravels and cobbles; while about 15 percent of the material is expected to be silts and finer-grained material.

The dredged material would be placed in steps. The first step would be to place the cobbles from the Ice Harbor lock approach either on the surface of the disposal site or along the outer edge of the planned footprint to form a berm. This would be followed by placement a mixture of the silt (less than 0.0024 inch in diameter), sand, and gravel/cobble, to fill the mid-depth portion of a site and form a base embankment. The dredged material would be transported by barge to the disposal area, where the material would be placed within the designated footprint. This footprint would be close to the shoreline, so that the river bottom could be raised to create an underwater shelf about 10 feet below the desired final grade. Because the barges may not be able to dump in the shallow depths, additional equipment would likely be needed to place or reshape the material to bring it up to the desired finished grade and slope. This may be accomplished by using hydraulic placement of material, which involves pumping the material from the barge through a pipe or hose to the surface of the disposal site and guiding the pipe so the material is placed where needed. It may also be accomplished by using equipment such as a clamshell bucket to move the material to meet the desired configuration.

The final step would be to place sand on top of the sand/silt embankment. An area of sand would be reserved as the final area to be dredged during the dredging activity. Sand would be placed on top of the base embankment in sufficient quantity to ensure that a layer of sand at least 10 feet thick covers the embankment once the final step of the process was completed. As described above, the sand could be placed using hydraulic placement or mechanical equipment. The final step includes placement or re-handling of the material to form a gently-sloping (3 to 5 percent) shallow area bench with water-ward edge depths down to 6 feet, finished on top of a stable base slope down to 20 feet deep, both measured at MOP. The sand cap layer would be created with a minimum thickness of 10 feet to ensure that the most desirable substrate (sand with limited fine-grained or silt material) was provided for salmonid-rearing habitat.

Monitoring embankment stability would be accomplished by performing hydrographic surveys soon after disposal was complete and periodically in the future to determine if the embankment slumped or moved. This information would be used to make adjustments in potential future dredged material placement, and to determine whether or not a berm should be constructed around the toe of the embankment to prevent movement. Monitoring of the biological use of the embankment would be accomplished by periodically sampling fish species in the area post construction.

3 FACTUAL DETERMINATIONS

3.1 Physical Substrate Determinations

3.1.1 Substrate Elevation and Slope

The existing substrate elevation at the RM 116 site is typically more than 25 feet below the minimum operating pool elevation, excluding the footprint of the previous disposal. The substrate slope ranges from approximately 16 to 60 percent near shore and approximately 1 to 4 percent on the existing bench. The proposed in-water discharge would raise the substrate elevation to create a shallow-water bench for fish rearing habitat.

Sand would be placed on top of the base embankment in sufficient quantity to ensure that a layer of sand at least 10 feet thick covers the embankment. The tops of the mounds would be flattened and leveled to form a smooth, gently-sloping (3 to 5 percent) shallow area with water depths up to 20 feet as measured at MOP. The sand cap layer would be created with a minimum thickness of 10 feet to ensure that the most desirable substrate (sand with limited fine-grained or silt material) is provided for salmonid-rearing habitat.

3.1.2 Sediment Type

The RM 116 site is located in a low velocity area that has been accumulating sediment since the filling of Lower Granite reservoir at an estimated rate of 2 inches per year. The substrate at this site was visually inspected in 1992 during a reservoir drawdown test. The substrate was observed to be primarily silt. Approximately 4 feet of silt are estimated to cover the bottom of the existing mid- to shallow-depth bench. Sediment samples were collected from the proposed material sources in August 2011. The results of grain size analyses conducted on these samples are as follows.

- Sediment samples collected from the main navigation channel in the confluence area contained 90 to 100 percent sand and 0 to 10 percent fines. The navigation channel would provide over 96 percent of the material to be discharged.
- Sediment samples collected in 2011 from the Ports of Lewiston and Clarkston were comprised primarily of 86 to 99 percent sand and 1 to 14 percent fines.
- The downstream lock approach site at Ice Harbor consists of large rock substrate and cobbles greater than or equal to 2-inches.

The overall composition of the sediments to be dredged is expected to be less than 30 percent silt and includes materials suitable to provide improved substrate conditions for aquatic organisms.

3.1.3 Dredged/Fill Material Movement

Materials used to construct the in-water habitat area at RM 116 would consist of sand with small amounts of silt and cobble. This material is not expected to move after placement based on results of the monitoring performed on the previous disposal at the site in

2005/2006. The site would be monitored after construction to determine if the embankment slumps or moves. Monitoring embankment stability would be accomplished by performing hydrographic surveys soon after disposal was complete and periodically in the future. Information gathered from this monitoring would be used to improve in-water placement strategies for future projects and to determine whether or not a berm is needed around the toe of the embankment to prevent movement.

3.1.4 Physical Effects on Benthos

Benthic organisms at the proposed in-water disposal site would be buried by discharge activities. However, the shallow-water and mid-depth habitat created is expected to be conducive to recolonization by benthic organisms from adjacent areas. Recolonization is expected to occur within 6 months of the disposal action.

3.1.5 Actions Taken to Minimize Impacts

- Alterations to substrate elevation and slope, and changes in substrate sediment type are designed to provide shallow-water fish habitat and are not considered adverse impacts.
- Material movement would be monitored at the site with periodic cross-section hydrographic surveys. Information gathered from this monitoring would be used to improve in-water placement strategies for future projects.
- Physical effects on benthos would be minimized by limiting discharges to a localized area, which is small relative to the reservoir system, and area would be offset by the shallow-water habitat created by the in-water discharge.

3.2 Water Circulation, Fluctuation, and Salinity Determinations

3.2.1 Water Chemistry

To minimize the potential for impacts to water chemistry, materials have been screened for selected chemicals prior to dredging. Also, turbidity, temperature, dissolved oxygen, and pH, would be monitored during the in-water discharge. Thus, the effects of in-water discharge on water chemistry are expected to be localized and short-term.

3.2.2 Temperature

Water temperature in the lower Snake River varies with time of year and location. Generally, water temperature is lower in the winter months of January and February, increases slowly during spring runoff (March to May), increases more rapidly in late spring until mid-summer (June to early August), plateaus through mid-September, then decreases steadily through January. For example, at the Lower Granite tailrace from December 2011 through March 2012, the average water temperature was 40.0°F (4.4 °C), with a maximum hourly temperature of 45.4 °F (7.4 °C) and a minimum hourly temperature of 35.2 °F (1.8 °C). Conversely, average temperature between July and September 2012 were 65.6 °F (18.7

°C) with a range of 61.3 °F (16.3 °C) to 68.1°F (20.1 °C). Temperature data collected at the dredge disposal site between 12 December 2005 and 6 March 2008 averaged 38.7 °F (3.7 °C).

The in-water discharge would be conducted during the in-water work window, when water temperature is relatively low. The creation of shallow-water fish habitat may result in a localized increase in water temperature at the disposal site. However, the area affected would be small relative to the reservoir system. The proposed in-water discharge is not expected to result in long-term impacts to the overall water temperature.

3.2.3 Light Attenuation

Water transparency in lakes and reservoirs is often evaluated using either Secchi disc or photic zone (where 1% of incident light remains) depths. Average Secchi depths at river mile 119 from December through March 2008 and 2009 were 2.8 m and 2.5 m, respectively. Mean photic zone depths during the same intervals were 6.1 m.

The in-water discharge and shaping of the material is expected to result in localized turbidity plumes. If operations cause an increase in turbidity of 5 nephelometric turbidity units (NTU) or greater over background (or 10 percent increase when background is over 50 NTUs) at the downstream compliance point from the project site, dredging operations would be stopped and/or modified until levels become lower and within the acceptable range. Turbidity would be monitored during in-water discharge.

Localized, short-term effects on water clarity are expected within the in-water discharge site and compliance boundary. These effects are expected to dissipate quickly. Long-term effects on water clarity are not anticipated.

3.2.4 Color

Water color is defined as the true and apparent color by a chroma analysis and is measured only after all turbidity is removed. Color in water may result from the presence of natural metallic ions (iron and manganese are the most common colorants in natural water), humus, plankton, weeds, and wastes. Excessive color affects both domestic and commercial uses and may require removal. A high resolution (upper end) scanning spectrophotometer or tintometer is required to measure true and apparent color. Actual true and apparent color is poorly understood in the lower Snake River since neither of these methods has been used. Potential impacts to color are expected to be minimal.

3.2.5 Odor

The Corps has not conducted standardized odor tests on the Snake River; therefore data are not available. Changes in odor are not anticipated in association with this project. However, unusual odors detected during dredging and in-water disposal would be investigated.

3.2.6 Taste

Taste test data approved by the American Society for Testing and Materials (ASTM) or the EPA are not available. Any potential changes in taste would likely be associated with suspension of sediments. Because turbidity increases would be localized and short-term, any change in taste would also be localized and of short duration.

3.2.7 Dissolved Gas Levels

Dissolved gas supersaturation has been one of the major water quality concerns in the Columbia River basin, including the Snake River, since the 1960s. Dissolved gas supersaturation is caused when water passing through a dam's spillway carries trapped air deep into the waters of the plunge pool, where increasing pressure causes the air to dissolve into the water. Most spillway discharges affecting dissolved gas levels occur during spring runoff between the months of March and June. The proposed in-water discharge would occur during the in-water work window (December 15 to March 1) and is not expected to affect dissolved gas levels. The resuspension of sediments with a high organic content could cause localized, short-term decrease in dissolved oxygen levels. However, because of the cooler water temperatures during the in-water work period, biological oxygen demand and other chemical processes which deplete the water of dissolved oxygen are greatly reduced. Dissolved oxygen concentrations at the 2005/2006 dredge disposal site averaged 12.7 mg/L, and the minimum value at any of the four monitoring locations was 10.3 mg/L.

3.2.8 Nutrients

Nutrient data was collected near the proposed disposal site between April 2008 and October 2010. The median total nitrogen concentration for the December through March period was 1.20 mg/L, and ranged from 0.93 to 2.4 mg/L. Nitrate was the prevalent form of soluble nitrogen in the water samples, accounting for approximately 75 percent of the total nitrogen. Total phosphorus concentrations near river mile 119 ranged from 0.03 to 0.11 mg/L during the same time period. These concentrations indicate that the reservoirs are generally eutrophic. The discharge of dredged material has the potential to increase nitrate and phosphorus levels. However, because the discharges would be conducted during winter months and during months of low primary productivity, impacts resulting from increased nutrient levels are expected to be localized and of short duration.

Ammonia is present in some of the sediments proposed for in-water fill. The amount of ammonia that would be released into the water is site specific, dependent upon temperature and pH of the water, and varies with the particle size of the material being dredged. Finer grained sediment (i.e., silt) would be expected to have higher ammonia concentrations and would be more likely to release larger amounts of ammonia into the water. Ammonia in the water column at the disposal site was monitored during the previous dredging event. The average concentration at the background station was 0.24 mg/L, while the mean values for the three downstream monitoring stations ranged from 0.19 to 0.29 mg/L. These concentrations were at least an order of magnitude less than the acute toxicity limit for salmonids established by the EPA for the average pH of the water during that time of the year.

3.2.9 Eutrophication

The in-water discharge and shallow-water habitat creation are expected to have localized, short-term effects on nutrient concentrations. Long-term effects resulting in increased eutrophication are not anticipated.

3.2.10 Current Patterns and Flow

Existing data on current and flow patterns at the proposed in-water disposal site are not available. The creation of shallow-water fish habitat may affect local current patterns and flow at the disposal site. However, these changes are expected to be beneficial to salmonids and other organisms.

3.2.11 Velocity

Velocity within the proposed discharge site is low as the site is on the inside of a river bend and within a reservoir. It likely varies with depth and location; however, measured velocity data at the proposed in-water discharge site are not available. The creation of shallow-water fish habitat may affect velocity at the in-water disposal site. However, these changes are expected to be beneficial to salmonids and other organisms.

3.2.12 Stratification

Thermal stratification has not been observed at the RM 116 in-water disposal site during the winter and is not expected to occur as a result of in-water disposal for the creation of shallow-water fish habitat.

3.2.13 Hydrologic Regime

In-water disposal for the creation of shallow-water fish habitat is not expected to affect the hydrologic regime. Changes in hydrologic regime are most likely to occur in response to changing weather patterns or changes in the overall management of flows in the lower Snake River system.

3.2.14 Normal Water Level Fluctuations

Normal water level fluctuations in the reservoirs are controlled at the dams. In-water disposal for the creation of shallow-water fish habitat is not expected to have a significant effect on water level fluctuations because the actual volume of sediment contained within the reservoir itself would not significantly change. The combined dredging and disposal operation would only serve to redistribute sediments from the upstream portion of the reservoir to a location further downstream within the reservoir. The material proposed to be removed from the Ice Harbor navigational lock approach and placed in Lower Granite reservoir only represents approximately 0.75 percent of the total volume to be dredged and is a relatively insignificant portion of the total volume. Proposed discharges would be designed to prevent the creation of standing water bodies in areas of normally fluctuating water levels.

3.2.15 Salinity Gradients

The proposed discharge site is located in a freshwater system. Because brackish and saline waters are not present, salinity gradients are not an issue for this evaluation.

3.2.16 Actions Taken to Minimize Impacts

- During in-water discharge, turbidity, and other parameters would be monitored for state water quality standards exceedances (see appendix J of the PSMP/EIS).
- If the applicable turbidity limit is exceeded at the compliance boundary, the in-water work would be stopped and disposal/construction methods would be modified to reduce the impact (to include modification of dredging timing, speed, or location).
- Effects on current patterns and circulation are designed to develop shallow-water fish habitat and are not considered to be adverse impacts.
- Normal water level fluctuations are controlled at the existing dams and would be maintained by designing in-water discharges to prevent the creation of standing water bodies.

3.3 Suspended Particulate/Turbidity Determinations

3.3.1 Expected Changes in Suspended Particulates and Turbidity Levels in the Vicinity of the Disposal Site

The turbidity standards in Washington and Idaho differ slightly. Washington regulations specify that turbidity shall neither exceed 5 NTUs over background levels when the background level is 50 NTUs or less nor have more than a 10 percent increase when background is more than 50 NTUs. The Idaho standard states that turbidity shall not exceed the background by more than 50 NTU instantaneously below the compliance boundary or by more than 25 NTU for more than 10 consecutive days.

The turbidity data collected upstream and downstream of the disposal location during the 2005/2006 channel maintenance project does show a few instances of elevated turbidity values. During the two and a half months when monitoring occurred 24-hrs per day, the number of instances when four-hour criteria was exceeded ranged from zero to two at the three shallow sondes, and from three to ten at the deep sondes. These events were primarily the outcome of scows releasing dredged material. It should be noted that between scows, which arrived approximately every six hours, turbidity levels returned to background levels for several hours prior to the subsequent scow.

Based on the turbidity data collected during the 2005/2006 channel maintenance project, in-water disposal for creation of shallow-water fish habitat is expected to result in a localized, short-term increase in turbidity. Turbidity would be monitored during disposal and construction activities to ensure that regulatory limits are not exceeded at the downstream compliance boundary.

3.3.2 Effects on Chemical and Physical Properties of the Water Column

Light penetration in the project site and compliance boundary would be reduced during disposal and construction activities. The effects are expected to be localized and short-term.

Dissolved oxygen may be reduced during disposal and construction activities. The effects are expected to be limited to the project site and compliance boundary. Dissolved oxygen levels are not expected to decrease below 5 mg/L, which is generally accepted to be the minimum concentration required for higher forms of aquatic life. The effects are also expected to be short-term. The work would be conducted during the in-water work window, when water temperatures are relatively cool and the solubility of oxygen is higher.

Elutriate tests were included in the August 2011 sediment sampling program. Analytes included metals, a suite of pesticides, polycyclic aromatic hydrocarbons (PAHs), petroleum hydrocarbons, semi-volatile organic compounds, as well as dioxins and furans, None of the detected concentrations exceeded the 2009 Sediment Evaluation Framework for the Pacific Northwest (SEF) or the National Oceanic and Atmospheric Administration 2011 Screening Quick Reference Tables (NOAA SQRT) for invertebrates.

Turbidity plumes associated with the proposed discharge may have a localized, short-term aesthetic impact. The impact would occur during the winter, when human use of the reservoir is minimal. The creation of shallow-water fish habitat is expected to provide long-term aesthetic benefits.

3.3.3 Effects on Biota

Increased turbidity is expected to have a short-term negative effect on primary production within the project site and compliance boundary. The effect would be localized, limited to the duration of the in-water discharge and habitat construction, and minimal during the winter when water temperatures are relatively low. The impact would not affect a significant percentage of the reservoir system's primary production.

Increased turbidity is expected to have a short-term negative effect on suspension feeders within the project site and compliance boundary. The effect would be localized and limited to the duration of the in-water discharge and habitat construction. The impact would not affect a significant percentage of the reservoir system's suspension feeders.

Increased turbidity is expected to have a short-term negative effect on resident sight feeders within the project site and compliance boundary. The effect would be localized and limited to the duration of the in-water discharge and habitat construction. The impact would occur during the in-water work window, which would minimize the number of salmonids present. The impact would not affect a significant percentage of the reservoir system's sight feeders.

3.3.4 Actions Taken to Minimize Impacts

- Expected changes in suspended particulate and turbidity levels would be minimized by managing and monitoring discharges to ensure that state water quality standards are not exceeded at the compliance boundary. If limits are exceeded, the in-water work would be stopped and discharge/construction methods would be modified to reduce the impact (to include modification of dredging timing, speed, or location).
- Effects on the chemical and physical properties of the water column would be minimized by chemical and physical screening of potential discharge materials. Sediments to be dredged have been evaluated for grain size distribution and selected chemical parameters. Results have been evaluated to determine that the sediments are suitable for the proposed in-water discharge.
- Effects on listed anadromous fish would be minimized by restricting discharges to the in-water work window, which is currently December 15 to March 1 in the lower Snake River.
- Effects on biota would be minimized by limiting discharges to a small area relative to the reservoir system.
- Materials discharged would be used to create shallow-water fish habitat. The long-term benefits of the improved habitat would offset for the localized, short-term impacts to biota described above.

3.4 Contaminant Determinations

The purpose of contaminant determinations is to determine the degree to which the proposed discharges would introduce, relocate, or increase contaminants. Under the general framework of Section 404 of the Clean Water Act, testing of dredged material is conducted to assist in making factual determinations regarding the effect of the discharge on the aquatic ecosystem.

The Corps had a series of analyses performed on samples collected in 2011 to determine chemical content of sediments at potential dredging sites in the lower Snake River and at the confluence of the Snake and Clearwater Rivers. The concentrations of the constituents, when detected, were all within the applicable guidelines presented in the 2009 SEF and the 2012 draft freshwater *Sediment Management Standards* (SMS) proposed for the Washington Administrative Code (WAC) 173-204. The concentrations of all but one of the metals were less than the in-water disposal criteria, often be an order of magnitude. The mercury concentration in one sample was slightly higher than the NOAA recommended level, but less than the thresholds presented in the SEF and the WAC. Carbamate pesticides, halogenated pesticides, organophosphorus pesticides, organonitrogen pesticides, phenylurea herbicides, semi-volatiles, glyphosate, and arochlor PCBs were not detected in any of the samples. The measurable PAHs, dioxin, and furan concentrations were all in the part per billion and part per trillion range, respectively, and well below the applicable criteria. Diesel was not found in any of the samples, but heavy oil residue was detected in one core sample at a concentration far below the allowable limit. Dioxin and furan toxic equivalents (TEQs) were also calculated for the sediment samples using the U = 0 and U = ½ method for comparisons. These TEQs were consistent with the results of previous studies in agricultural soils in Washington and less than Puget Sound background levels. The material proposed to be dredged for the immediate need action met the criteria for unconfined open in-water disposal.

One of the potential dredging sites, the Port of Clarkston's Crane Dock site at RM 137, had not yet been sampled at the time this evaluation was being prepared. The Port's contractor has received approval of their sampling and analysis plan for the Crane Dock site and plans to sample the sediment in early December 2012. The samples will be tested as per the 2009 SEF and the results should be available in January 2013. This evaluation will be updated with those results prior to finalization. The Corps anticipates the sediment from the Crane Dock will also be suitable for unconfined open in-water disposal.

3.5 Aquatic Ecosystem and Organism Determinations

Most phytoplankton and zooplankton populations would be in the resting stage during the winter months of the in-water work window. The localized, short-term impacts of the in-water discharge and habitat creation are not expected to have a significant effect on plankton populations.

Benthic organisms would be buried or displaced by the in-water discharge. However, the shallow-water habitat created is expected to provide a suitable substrate for re-colonization by organisms from adjacent benthic communities.

The in-water work window is timed to avoid migrations of anadromous salmonids and minimize the number of salmonids present in the project area during in-water work. Swimming organisms that are present during the in-water discharge would likely be displaced, but may also be incidentally destroyed by construction activities. The localized, short-term impacts of the in-water discharge are not expected to have a significant effect on nekton populations. The shallow-water habitat created is expected to provide long-term benefits for salmonids and other nekton.

Because most of the spring and summer dominant species of plankton are in the resting stage during the winter in-water work window, impacts to the spring and summer food web are not expected. The winter months have a different food web than the spring, summer, and fall months. Because most freshwater aquatic organisms are poikilothermic, the bioenergetics of the system slow down in parallel to the decrease in temperature. Some organisms feed very little in the winter and live off stored fat reserves. Aquatic insects do feed and rely on detritus for food sources. The winter phytoplankton species are relatively unstudied. Because the impacts of the in-water discharges are limited to the project site and compliance boundary, significant impacts to the winter food web outside of the project site are not expected.

Wetlands are not present at the disposal site. Sanctuaries and refuges, mud flats, vegetated shallows, coral reefs, and riffle and pool complexes are not present at the disposal site.

3.5.1 Threatened and Endangered Species

The proposed discharge site is designed to develop habitat that would provide long-term benefits for listed salmonids. The Corps conducted surveys at the RM 116 site, prior to use of the area for disposal, to determine if the area is currently being used by listed species (Tiffan and Connor 2012, Artzen et al. 2012). The survey results indicated that few juvenile salmonids are currently using the downstream portion of the site, but juvenile SR fall Chinook are using the dredged material at the upstream end of the site for resting and rearing. The proposed in-water disposal at the downstream end of the site is expected to create additional shallow-water habitat with the potential to increase resting/rearing habitat for juveniles of listed salmonids, especially SR fall Chinook.

The Corps is preparing a biological assessment that addresses the effects of the proposed dredging and disposal activities on Endangered Species Act- (ESA) listed species and their designated critical habitat (Appendix K of the PSMP/EIS). The Corps plans to provide this biological assessment to National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) in December 2012 and will be requesting formal consultation. The Corps determined that the maintenance dredging and beneficial use of dredged material to create shallow-water salmonid habitat “may affect and is likely to adversely affect” SR fall Chinook, SR spring/summer Chinook, and SR steelhead and their designated critical habitat; “may affect but is not likely to adversely affect” SR sockeye salmon; middle Columbia River and upper Columbia River (UCR) steelhead, UCR spring Chinook, and UCR steelhead and their designated critical habitat; and “may affect, is likely to adversely affect bull trout and their designated critical habitat, and; would have “no effect” on gray wolf, Canada lynx, Ute ladies’-tresses, Spalding silene, and pygmy rabbit. The result of ESA consultations with NMFS and USFWS will be included in Appendix K of the PSMP/EIS.

3.5.2 Wildlife

The impacts to wildlife species as a result of dredging and in-water disposal at RM 116 are expected to be indirect, short-term and minor, primarily as a result of displacement during the operation. The proposed dredging and disposal activities would occur within the river and would not prevent wildlife from obtaining food or otherwise using the areas adjacent to the dredging and disposal activities. Riparian habitat, as well as shoreline perch trees for raptors and other birds, would not be impacted. Waterfowl, birds, aquatic furbearers, and other wildlife would use areas upstream and downstream of the sites where dredging and disposal activities occur. Dredging and disposal would not be a continuous activity confined to a single location. Waterfowl and other wildlife would return to the areas shortly after completion of the dredging and disposal. Mammals such as mule deer would not be impacted since there would be no existing upland areas affected. The Corps anticipates there would be no long-term direct or indirect impacts to vegetation or wildlife from the proposed dredging and disposal activities.

3.5.3 Actions to Minimize Impacts

- Effects on plankton would be minimized by restricting discharges to the in-water work window, when the majority of plankton populations are in a resting stage, and by limiting discharges to a small area relative to the size of the reservoir system. In-water work would be monitored to ensure that direct impacts caused by an increase in turbidity are limited to the compliance boundary.
- Effects on benthos would be minimized by limiting discharges to a small area relative to the size of the reservoir system.
- Effects on listed salmonids would be minimized by restricting discharges to the in-water work window, which is timed to avoid migrations of anadromous salmonids and minimize the number of salmonids present is the project area during in-water work.
- Effects on nekton would be minimized by limiting discharges to a small area relative to the reservoir system. In-water work would be monitored to ensure that direct impacts caused by an increase in turbidity are limited to the compliance boundary.
- Impacts to the aquatic food web would be minimized by restricting discharges to the winter in-water work window, which minimizes impacts to spring and summer plankton populations, and by limiting discharges to a small area relative to the size of the reservoir system.
- Potential short-term, localized impacts to plankton, benthos, nekton, the aquatic food web, and listed salmonids would be offset by the long-term benefits created by development of shallow-water fish habitat.

3.6 Proposed Disposal Site Determinations

3.6.1 Compliance Boundary Determination

The size of the allowable compliance boundary has not yet been determined, but would likely be similar to what was used for the 2005/2006 dredging. That boundary would be based on a 1,000 feet x 600 feet dredging zone in which the dredge would operate. Monitoring stations would be set up at points 300 feet upstream of the zone to measure background conditions, and 300 and 600 feet downstream of the zone at the edge of the compliance boundary to measure compliance. The Corps is coordinating with Idaho Department of Environmental Quality and the Washington Department of Ecology to determine the applicable compliance boundary.

3.6.2 Determination of Compliance with Applicable Water Quality Standards

Section 401 of the Clean Water Act requires that applicants requesting a Federal license or permit to conduct activities that may result in a discharge into waters of the United States, provide, to the licensing or remitting agency, a certification from the State that any such discharge complies with applicable provisions of the Clean Water Act and state water quality standards. The Corps will be requesting Section 401 Water Quality Certification from the Washington Department of Ecology as the disposal would occur in Washington. Although the Corps would not be disposing of any dredged material in Idaho, the Corps is requesting a Short Term Activity Exemption from Idaho Department of Environmental Quality for the dredging activities that would take place in Idaho.

3.6.3 Potential Effects of Human Use Characteristic

Municipal and public water supply intakes are not located in the vicinity of the proposed discharge site at RM 116.

Commercial fishing is not conducted in the vicinity of the proposed disposal site or the dredging sites. Recreational fishing for Snake River steelhead and resident fish does occur in the vicinity. In-water disposal and habitat creation activities may have a localized, short-term impact on recreational fishing in the immediate vicinity of the site. Short-term impacts would be minimized by restricting work to the in-water work window, which is not during a period of high recreational use. The creation of shallow-water fish habitat is expected to have a long-term beneficial effect on recreational fisheries.

Numerous aquatic species, including salmonids, Pacific lamprey, sturgeon, whitefish, and sculpin, retain cultural significance to tribes. Tribal interests and rights are viewed by tribes and traditional communities with the spatial context of tribal ceded lands, traditional native homelands, and places traditionally used by native peoples. Of particular concern to tribes are the potential impacts of water resource management on anadromous fish runs and associated aquatic habitats, and tribal rights to fish for ceremonial, subsistence, and commercial needs.

Short-term impacts to fisheries would be minimized by restricting work to the in-water work window, which is designated to reduce impacts to anadromous salmonids. The creation of shallow-water rearing habitat is expected to have a long-term beneficial effect on fisheries.

Recreational facilities such as boat ramps or developed swimming beaches are not present at the proposed discharge site at RM 116. Recreational activities may occur in the vicinity of the RM 116 throughout the year; however, recreational use is lower during the in-water work window than the rest of the year. In-water disposal and habitat construction is expected to have a minor, localized, short-term effect on recreational activities.

The disposal site at RM 116 is somewhat remote and therefore, the number of people viewing the site would be limited. During in-water disposal and habitat creation, barges placing material at the site would be visible to recreational users on the river and roadway travelers. The activities proposed at the RM 116 site would have localized and short-term impacts on aesthetics. Also, the disposal site is not located in or adjacent to any parks, national seashores, wilderness areas, or wild and scenic rivers.

3.7 Determination of Cumulative Effects on the Aquatic Ecosystem

Cumulative effects of the proposed in-water disposal activities would most likely be associated with aquatic resources. Benthic communities would continue to be displaced by future sediment management actions including dredging and disposal activities. However, these communities would be expected to reestablish within 6 months to 1 year. Future sediment management actions could have the potential to negatively impact listed salmonids, but these impacts would be minimized by performing the work during a period when few individuals of the listed species would be present or by incorporating design features that would minimize the effects on salmonids. The Corps would likely continue to create shallow-water fish habitat with any material that is dredged. The additional habitat would be expected to provide long-term cumulative benefits for the aquatic ecosystem. Additional analysis of cumulative effects can be found in Section 4 of the PSMP/EIS.

3.8 Determination of Secondary Effects on the Aquatic Ecosystem

Secondary effects, such as water level fluctuations, septic tank leaching, and surface runoff from residential or commercial development on fill, are not expected to be associated with the proposed in-water disposal and shallow-water habitat creation.

4 FINDINGS OF COMPLIANCE OR NON-COMPLIANCE WITH THE RESTRICTIONS ON DISCHARGE

4.1 Adaptation of the Section 404(b)(1) Guidelines to this Evaluation

No significant adaptations of the Guidelines were made relative to this evaluation.

4.2 Evaluation of Availability of Practicable Alternatives to the Proposed Discharge Site Which Would Have Less Adverse Impact on the Aquatic Ecosystem

The habitat value at the proposed disposal site would be improved, and not adversely affected, by the proposed action. Upland disposal was considered; however, the upland disposal option available was not practicable at this time. Several in-water disposal options were considered. The proposed disposal minimizes impacts to the aquatic environment while providing the greatest beneficial use of all the alternatives considered. Additional information on the alternative considered can be found in section 2 of the EIS main report.

4.3 Compliance with Applicable State Water Quality Standards

In-water disposal and habitat construction activities would be monitored for impacts to water quality. Actions would be taken to reduce resulting impacts to a level within the criteria set forth in applicable state standards.

4.4 Compliance with Applicable Toxic Effluent Standard or Prohibition Under Section 307 of the Clean Water Act

Materials to be dredged have been sampled and analyzed for selected metals and organic compounds. Contaminant concentrations measured were below the screening levels prescribed in the May 2009 Sediment Evaluation Framework for the Pacific Northwest.

4.5 Compliance with Endangered Species Act of 1973

The Corps is consulting with NMFS and USFWS regarding listed species at sites included in the proposed work. A biological assessment evaluating effects on listed species is in Appendix K of the PSMP/EIS.

4.6 Compliance with Specified Protection Measures for Marine Sanctuaries Designated by the Marine Protection, Research, and Sanctuaries Act of 1972

Designated marine sanctuaries are not located in the proposed work area.

4.7 Evaluation of Extent of Degradation of the Waters of the United States

4.7.1 Significant Adverse Effects on Human Health and Welfare

Municipal and private water supply intakes are not located in the vicinity of the proposed discharge sites. Such water supplies are not expected to be adversely affected by the proposed in-water disposal activity.

Commercial fisheries are not present in the lower Snake and Clearwater Rivers. Recreational fishing for Snake River steelhead and resident fish does occur in the vicinity. In-water disposal and habitat creation activities may have a localized, short-term impact on recreational fishing in the vicinity of the site. Short-term impacts would be minimized by restricting work to the in-water work window, which is not during a period of high recreational use.

Localized, short-term impacts to plankton, benthic communities, and listed salmonids are expected to be offset by the long-term benefits provided by additional shallow-water fish habitat. Significant, adverse impacts to other fish populations are not anticipated.

The impacts to wildlife as a result of dredging and in-water disposal are expected to be indirect, short-term and minor, primarily as a result of displacement during the operation. The proposed dredging and disposal activities would occur within the river and would not prevent wildlife from obtaining food or otherwise using the areas adjacent to the activities.

Wetlands are not present at the RM 116 disposal site. Sanctuaries and refuges, mud flats, vegetated shallows, coral reefs, and riffle and pool complexes are not present at the discharge site.

4.7.2 Significant Adverse Effects on Life Stages of Aquatic Life and Other Wildlife Dependent on Aquatic Ecosystems

The in-water work window had been scheduled to avoid migrations of anadromous fish. Localized, short-term effects on resident aquatic life are expected to be offset by the long-term benefits provided by additional shallow-water fish habitat. Impacts to wildlife are expected to be indirect, short-term and minor, primarily as a result of displacement during the operation.

4.7.3 Significant Adverse Effects on Aquatic Ecosystem Diversity, Productivity and Stability

Localized, short-term effects on the productivity of plankton and benthic communities in the proposed disposal site are expected to be mitigated by the creation of shallow-water habitat. The additional habitat is expected to be conducive to recolonization by more diverse, productive, and stable populations.

4.7.4 Significant Adverse Effects on Recreational, Aesthetic, and Economic Values

Adverse effects on economic values are not expected. Adverse effects on recreational and aesthetic values are expected to be localized and short-term. The long-term effects of creating additional shallow-water fish habitat are expected to be beneficial.

4.8 Appropriate and Practicable Steps Taken to Minimize Potential Adverse Impacts of the Discharge on the Aquatic Ecosystem

- In-water discharges would be used to develop shallow-water fish habitat.
- In-water discharge would be restricted to December 15 to March 1.
- Materials to be dredged have been sampled and analyzed for grain size distribution and selected chemical concentrations.

- Dredged material to be discharged does not have significant contaminant concentrations.
- Water quality monitoring would be performed prior to, during, and after in-water disposal activities as described in the monitoring plan (see Appendix J of the PSMP/EIS).
- Data collected from the project would be used to improve management of future sediment management activities.

4.9 Finding of Compliance or Non-Compliance

The discharge complies with the Section 404(b)(1) Guidelines with the inclusion of the appropriate and practicable steps taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem. Because the project does not involve placement of fill in waters of Idaho, a short-term activity exemption will be requested from the Idaho Department of Environmental Quality. The Corps will be requesting Section 401 water quality certification from Washington Department of Ecology.